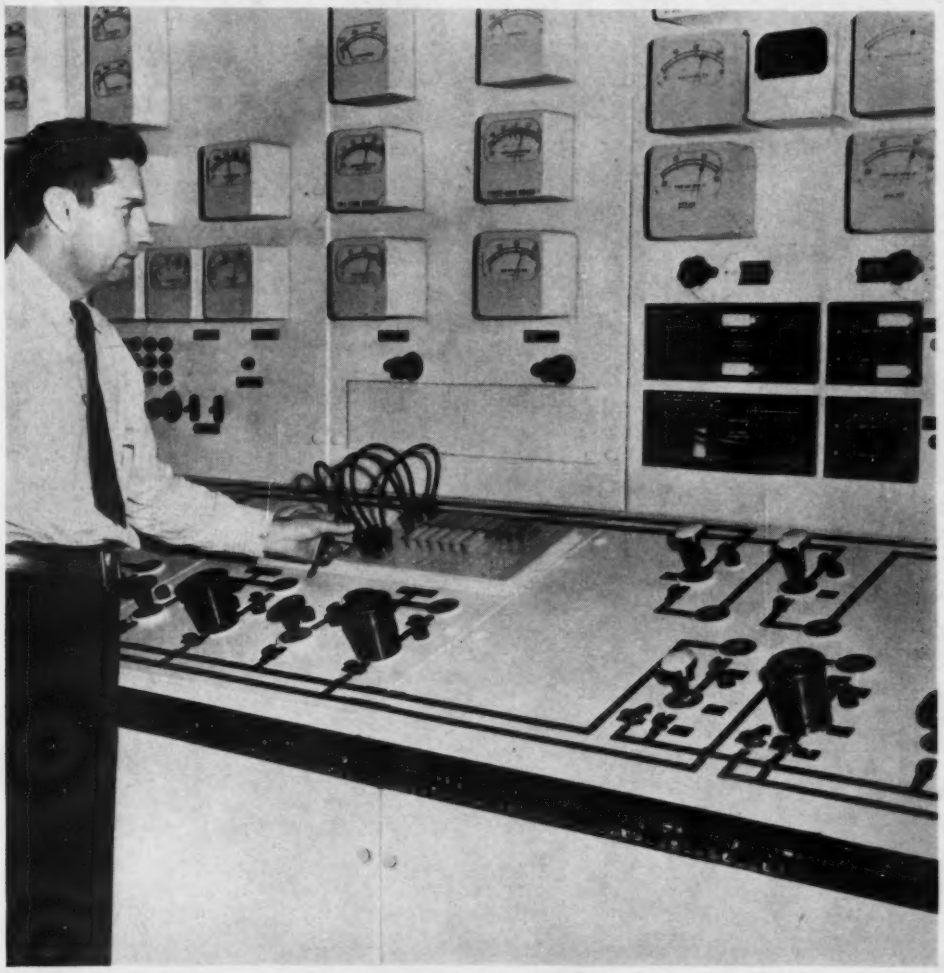
Electrical World

SEP 17 1946



SEPTEMBER 14, 1946

Supplying Station Auxiliaries • Results of House Heating Tests

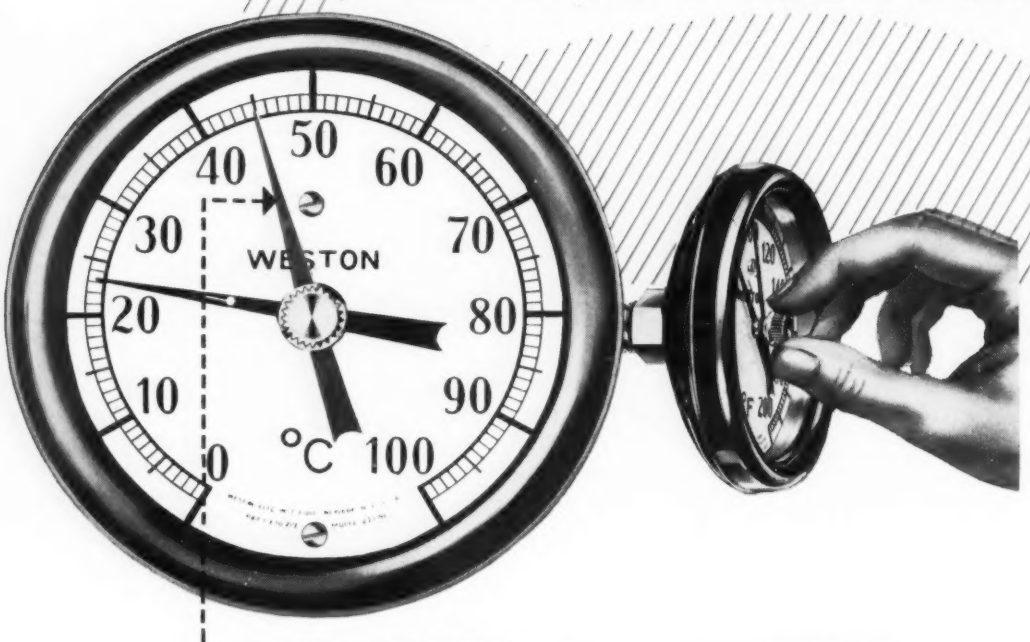
Secondaries For Modern Home Loads • New Pole Seasoning Process

Power Factor Corrected by Current Control

A McGRAW-HILL PUBLICATION

NEW all metal WESTON

MAXIMUM-MINIMUM Thermometer



RED INDEX shows the highest or lowest temperature reached!

Simply swing the red index to the low side of the temperature pointer, and the index will move to the *lowest temperature reached,* and *remain there* until manually reset. For *highest temperature* record, simply swing the red index around to the high side of the pointer.

The index movement in no way impairs the guaranteed high accuracy of the WESTON Thermometer.

Thus the WESTON Maximum-Minimum Thermometer provides, at only slightly above ordinary thermometer prices, a means of obtaining high or low temperature records on equipment or processes where these extreme temperatures are critical. Ideal for transformers, sterilizers, ovens, chemical equipment, food processing, etc. For complete information, consult your nearest WESTON representative. WESTON ELECTRICAL INSTRUMENT CORPORATION, 578 Frelinghuysen Avenue, Newark 5, New Jersey.

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Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 72 YEARS

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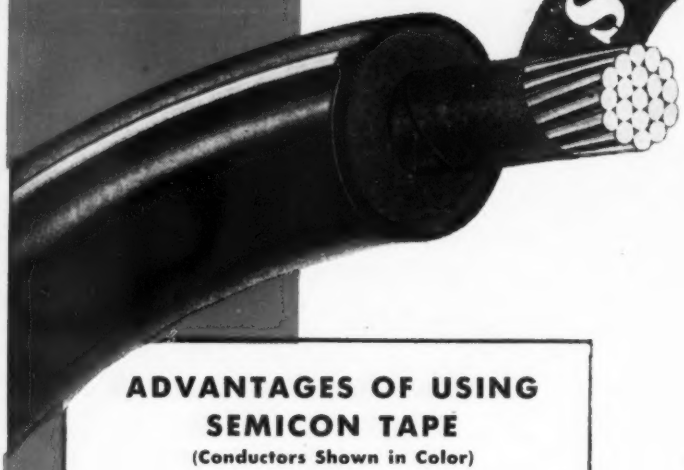
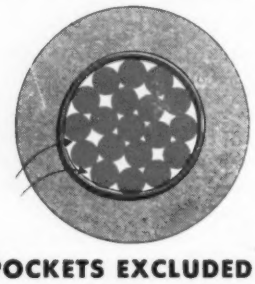
SEMICON TAPE



. . . PREVENTS INTERNAL CORONA CUTTING IN HIGH VOLTAGE CABLES

ADVANTAGES OF USING SEMICON TAPE

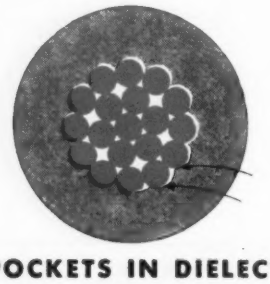
(Conductors Shown in Color)



AIR POCKETS EXCLUDED FROM DIELECTRIC FIELD

WITH SEMICON

1. Uniform stress conditions result from smooth, cylindrical conducting surface
2. No voids develop because Semicon tape and insulation are vulcanized together
3. No internal corona cutting can occur since the voids which cause it are eliminated



AIR POCKETS IN DIELECTRIC FIELD

WITHOUT SEMICON

1. Points of high stress exist because of irregular conductor surface
2. Voids, gaps or "pockets" can develop because cable movements may distort insulation
3. Voids under stress result in ionization (internal corona cutting)

Longer cable life through greater built-in protection – that's what users of high voltage cables are assured by the Semicon tape now an integral part of every rubber insulated cable made by Okonite for operation at voltages above 2000 between phases.

Semicon tape is a strong cotton fabric impregnated and coated on both sides with a semi-conducting neoprene compound developed in the Okonite laboratories. It is applied between the Okoloy-coated conductor and the rubber insulation, being wrapped helically around the conductor with sufficient lap to insure complete coverage. It is bonded to the inner surface of the insulation during vulcanization so that no voids or spaces are present in which corona cutting of the inner surface of the insulation might start.

Comparative cross-section views at left show at a glance the advantages of Semicon tape . . . the absence of voids or air pockets next to the insulation at the conductor surface where the electrical stress is high.

Even under the most severe test conditions, no failure caused by internal corona cutting has ever developed in a cable made with Semicon tape, first used in Okonite-engineered cable in 1938. Furthermore, Semicon tape has considerably raised voltage test values. As a result, factory a-c high voltage tests have been increased by 25 percent, a standard Okonite precaution that provides additional insurance against the possibility of insulation defects.

For further information on Semicon tape and the high voltage cables in which it is used, get in touch with Okonite engineers. The Okonite Company, Passaic, N. J.

OKONITE

insulated wires and cables

4403

LABOR DAY • 1946

– Time for wise union leadership

LABOR DAY, 1946, finds one hopeful element in the relations between American management and labor which was not there on Labor Day, 1945. It comes in recent expressions by a number of national leaders of organized labor that increased "real" wages depend upon *increased productivity,* i.e. increased output per man-hour. Increased money wages which are promptly offset by higher prices do nobody any good.

If these expressions, *which still remain to be substantiated by practical performance,* come to be accepted by the rank and file of labor in each community, Labor Day, 1946, can usher in a period of great and perhaps unprecedented improvement in the economic wellbeing of wage earners – as well as the wellbeing of the country at large. If, on the contrary, they remain merely window dressing and there is a continuation of the post V-J Day process of increasing wages and then prices, the outcome can only be the bursting of an inflationary bubble, with attendant suffering for workers and the community generally.

Competition requires management to bear down heavily on increased labor productivity as a prelude to wage increases. Management, however, has rarely made a more forthright statement on the importance of increasing labor productivity than that contained in a recent issue of LABOR'S MONTHLY SURVEY, an official publication of the American Federation of Labor.

William Green, the Federation president, led off with a "message to American workers." He remarked, "Our major need is increased volume of production." Observing that "wage increases this spring have been paid for by raising prices," the survey itself goes on to say that "Today America's ability to raise wages without increasing prices and living costs depends on increasing productivity in civilian industries . . . Here is the challenge to free labor and free enterprise today: *Cooperate to increase productivity and raise living standards without strikes.*" (Italics supplied.)

The importance of increasing production was also recently stressed by Walter Reuther, President of the United Automobile Workers, C.I.O., who remarked that his union "is just as eager as management to get the (automobile) industry into maximum production." In taking this general line he was in accord with the position of Philip Murray, head of the C.I.O., who in a book, "Organized Labor and Production" written with Morris L. Cooke, remarks that, "The modern labor leader also realizes that to receive a good day's pay a man must do a good day's work and that *increased productivity has been the vital factor in the country's industrial supremacy and its relatively high wage scale.*" (Italics supplied.)

In citing increased productivity as the key to increased "real" wages these labor leaders—and management – have the historical record entirely on

SPOT CHECK ON LABOR OUTPUT

In the absence of reliable general statistics on what has happened to productivity of labor since V-J Day (because of strikes and reconversion complications) the McGraw-Hill Publishing Company asked the executives of a cross section of American industry to report their own impressions. The questions asked and summaries of the replies, which varied markedly from industry to industry and plant to plant, follow.

Question No. 1. How well have workers performed since V-J Day as compared to their pre-war effort?

Answer. Worker effort has been below pre-war. There are exceptions, particularly among older and more experienced workers; and there are quite a few signs of improvement.

Question No. 2. How much headway have you been able to make since V-J Day in improving labor productivity by better equipment and organization?

Answer. Some headway is generally being made, but it has been greatly retarded by inability to get new equipment and, in some cases, by lack of labor cooperation in improvements in organization.

Question No. 3. How much improvement in equipment and organization is to be anticipated in your business over the next year?

Answer. Marked improvement in productivity (in a few cases as much as 20 per cent) can generally be made if there is sustained production and full cooperation between labor and management.

their side. In the 40 years prior to the outbreak of World War II output per man-hour for the country as a whole was approximately doubled. Over the same period the "real" hourly earnings of industrial workers were also approximately doubled. There were, of course, great variations in the increase of output per man-hour from one line of activity to another. Also, there were periods when increases in "real" wage rates lagged behind increases in productivity. But for the 40 year period as a whole and the economy as a whole there is no mistaking the fact that the route to increased "real" wage rates was increased productivity.

Three economic factors played major roles in this doubling of production per man-hour which has made America the industrial marvel of the modern world. One was the skill and diligence of American workers. A second was the skill and diligence of American management in organizing production. A third was the improvement of machinery and the increased application of power to it.

Wartime Record

During World War II this sustained increase in the productivity of labor in *civilian* manufacturing industries, which had averaged about 3 per cent a year, was brought to an abrupt halt. Much of the most efficient segment of the nation's labor force went to war or war industry. Also, civilian industry was starved for new equipment while we equipped our arsenals. The result was that the productivity of labor in those civilian manufacturing industries for which the government keeps records actually declined throughout most of the war. By 1945 it was no higher than in 1941, whereas, if it had maintained the long run average, it would have been about 12 per cent higher. In the meantime, however, average hourly wages in these civilian industries had increased about 40 per cent.

In *war* industry, which started from low levels of production at strange tasks, there were substantial increases in output per man-hour. Many of these increases involved new processes, improved techniques, and better machines which can be adapted over a period of time to the improvement of productivity of labor in civilian industry.

Since V-J Day, however, labor, led on by a misguided government, has had its sights on higher money wages instead of improving productivity which would have laid the foundation for increased "real" wages. Consequently, debilitating industrial strife ended in a round of wage increases which, in the absence of increased productivity, is being washed out by higher prices.

To Keep Production Rolling

However, as indicated by the summary of a McGraw-Hill sampling of the current experience of industry in increasing output per man-hour, which appears in the center of the page, there is hope that the situation ahead can be improved. After agonizing delays because of work stoppages, material shortages, and reconversion complications, industrial production is beginning to roll again. Allowed to roll it will not be long before it will be making those advances in productivity which are the only true basis for increased "real" wages.

If the process of keeping American industry rolling to new highs of productivity is to be resumed, management must see that the past practice of translating increased output per man-hour into increased "real" wages is not only sustained but wherever possible accelerated. For its part organized labor must abandon its manifold feather bedding rules and other production-restricting practices which afflict considerable segments of American industry. Further it must give incentive systems of pay, honestly conceived and honestly administered, a fair break. *Management and labor and government and the community at large must collaborate in removing that specter of working one's self out of a job which has been one of the greatest causes of restriction of output.*

The current emphasis by leaders of organized labor on the economic truth that increased output per man-hour is the only road to increased "real" wages is important. The next step is to see that recognition of this truth seeps into the rank and file of labor and industry and becomes the basis of a program of action at the local level. If it does, and quickly, Labor Day, 1946, may mark a tremendous turning point toward sustained prosperity not only for labor but the community at large. If it does not, union leadership will fail in its responsibility and must answer to the American people for the consequences of such a failure.

President McGraw-Hill Publishing Company, Inc.

Electrical World

SEPTEMBER 14, 1946

The Problem of New Connections

CONCERN is being expressed by some utilities that they may not be able to connect all the new customers wanting service because of inability to secure the necessary line equipment. In fact a few have given consideration to warnings to the public that applications for service in some categories may have to be held up.

There is no question but what the situation presents a problem meriting serious attention and with the big veterans' housing construction program being strongly pressed, it is evident that the demands on utilities for new services will be greater still.

Strikes in the first half of the year in steel, copper and electrical manufacturing are responsible almost entirely for the predicament the industry finds itself in today. Nevertheless, although certain local situations appear to be becoming more precarious, the over-all picture of production is improving and, assuming no further set-backs, in another six months may be such that the bottleneck is no longer equipment but local construction labor.

Distribution transformers, for instance, which have been a major source of difficulty, are now reported to be at a production level nearly equal to the all-time high with prospects that by the first of the year output of some factories may be half again as good. Meters appear to be in a similar situation. If there is any considerable duplication of orders, as appears likely, backlogs will melt away rather fast under such stepped-up production.

With the outlook what it is it would seem to be advisable not to raise the alarm at this time that new housing might have to wait for electric service. Any fear of that nature would undoubtedly find quick expression in a demand for re-control by Washington of deliveries of distribution materials. While it is true that an increasing number of utilities are now seeking assistance of the Civilian Production Administration in procuring needed equipment and that measures used by CPA may not always be as effective, any return to rationing under priorities regulation is to be avoided as long as possible.

There is no question but what veterans' housing will get service. The only question is whether it will come with or without government re-control. Some companies have already set up an allocations control to assure that first things come first, such as minimum stocks for emergency, hospitals and public safety needs, veterans' housing, commercial and industrial service and non-veterans' housing, in that order. If such local self-controls are made effective it should not be necessary for any government orders to be re-established.

As a matter of public relations, the industry may be in a much more vulnerable position if in six months or so the backlog of production has been broken but there is insufficient labor to install, test and process the equipment in the field. Should that happen the blame could not be laid at the doors of others.

Unfavorable as the situation appears to be today in a great many places, the industry can reap its best public relations dividend by doing this difficult task itself. The less assistance it gets by way of controls the better position it will be in to tell the people what it is doing that they may be served.

Data from Portland

HOUSE-HEATING *Tests*

Diversified demand on system peak found to be 5.3 kw. for unit heaters and 6.4 kw. for central furnaces

W. L. SHARP, *Rate Engineer, Portland (Ore.) General Electric Co.*

TESTS to determine the characteristics of electric house heating load being conducted by Portland General Electric Co. were started in November 1945, and data for the seven month period December 1945 to June 1946, inclusive, are here made available. The objectives to be attained and the methods of testing were described in ELECTRICAL WORLD, for March 16, 1946, page 82, and the procedure outlined has been followed. There has been no change in the policy of limiting the tests to resistance heating of two types, i.e., thermostatically controlled unit heaters and central furnaces, for those were practically the only types of electric house-heating equipment in service on the lines of the utility when the tests were started. The number of these installations has now grown to approximately 1,000.

The past winter in Portland, Salem and the territory served by the company has been relatively mild, the coldest weather occurring in December when the minimum temperature was recorded at 26 deg. F. Actual degree days for the months December 1945 to June 1946 inclusive were, 3,126, compared to a normal of 3,374 degree days for the same period. The normal total annual for Portland is 4,379 degree days.

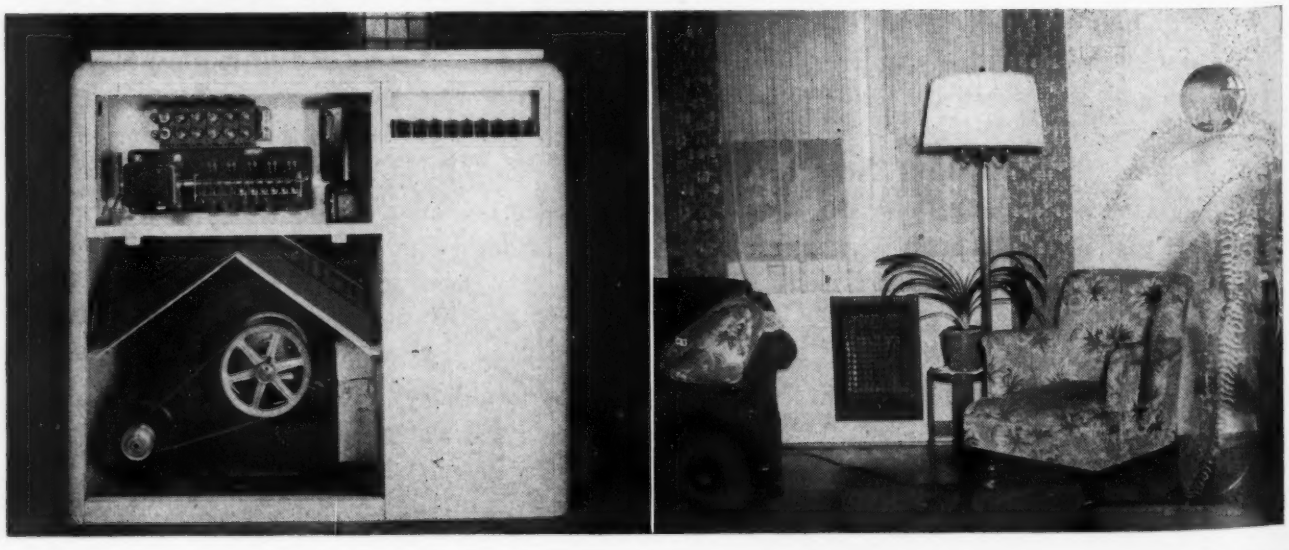
The maximum average coincident peak for test customers, occurring between 6:00 and 8:00 A.M. in December, was 7.3 kw. for unit heaters and 10.6 kw. for central furnaces. Coincident with the system peak for 1945, which occurred between 5:00 and 5:30 P.M. on December 20, unit heater load averaged 5.3 kw. and central furnace load averaged 6.4 kw. The accompanying chart shows the diversified loads of both types of heating by half-hour intervals for December 20 when the system peak occurred.

An approximate calculated figure of 14-percent saturation of electrically heated residences to equalize morning and evening peaks on residential load was developed from the application of house-heating load characteristics to the measured load on a typical residential feeder serving approximately 1,300 residential customers. A test on a secondary serving 14 homes, two of which were electrically heated, showed about the same result. The secondary served a total connected load of 190 kw., consisting of two 20-kw. central furnaces, 11 ranges, 9 water heaters, and lights and appliances. One 30-kva. transformer fed the secondary. The maximum recorded transformer oil temperature was 52 deg. C.

Annual Load Factors Low

The accompanying tabulation, "Heating Data Summary" shows the principal results of the tests for the past seven months. These figures are for the heating load only and do not

TWO TYPES of electric house heating are presently included in the Portland tests. At left is view of modulator control central furnace. Typical unit heater installation is shown on the right



include other household use. Projecting the energy consumption through a 12-month period on a degree-day relationship adjusted to the Weather Bureau normal for Portland, the average annual requirement is estimated at 16,600 kw.-hr. for central warm air systems and 12,800 kw.-hr. for unit heater systems. As indicated by the tabulation, the average size of the houses is about the same, namely on the order of 10,500 cu.ft. Using the average maximum coincident demands of 10.6 kw. for central furnaces and 7.3 kw. for unit heaters, the annual load factors under the above kilowatt-hour assumptions become 17.9 percent and 20.0 percent respectively.

These load factor values are probably in error to some extent and are set forth herein simply as general indications. The annual energy consumption has been "blown up" by increasing actual values and projecting the remainder of the year on a normal degree-day basis (actual degree-days for the past 7 months have been about 8 percent below normal) while the demands have not been adjusted. The tests have not so far developed any relationship between demands and weather conditions which can be relied upon for extrapolation.

Rate and Costs

Pending the results of the tests now in progress and studies of the annual costs involved in serving house-heating load, an interim rate schedule has been made effective applicable to residential space-heating. The rate is designated as Schedule 9, and simplified, may be expressed as follows:

Monthly Rate:

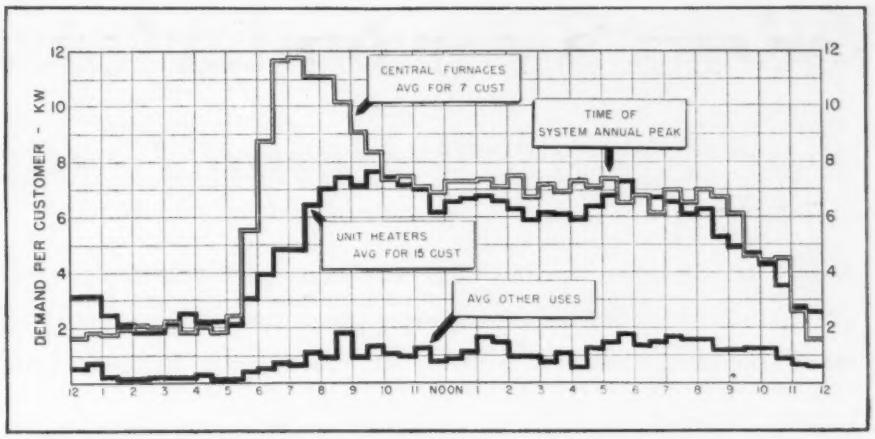
First 300 kw.-hr. or less, $4.50.

Next 700 kw.-hr. at 6 mills per kw.-hr.

Over 1,000 kw.-hr. at 8.5 mills per kw.-hr.

Excess over 10 kw. of demand at $1.14 per kw.

Under this rate, the average cost to the customer for 7 months for central furnace service has been $125.43 or 1.01 cents per kilowatt-hour. For unit heater service the average cost has been $88.97 or 0.93 cents per kilowatt-hour. Application of these averages to the estimated annual energy consumption results in a cost to the customer of $167.66 as an average for central furnaces and $119.04 as an average for heaters of the unit type.


DEMAND PER CUSTOMER - KW
CENTRAL FURNACES
AVG FOR 7 CUST
TIME OF
SYSTEM ANNUAL PEAK
UNIT HEATERS
AVG FOR 15 CUST
AVG OTHER USES
12 1 2 3 4 5 6 7 8 9 10 11 NOON 1 2 3 4 5 6 7 8 9 10 11 12

AVERAGE coincident half-hour demands for all services to 22 customers included in house-heating tests; seven central heating furnaces averaging 17 kw. and 15 unit heater installations averaging 16 kw. connected. Thursday, December 20, 1945, minimum temperature 31 deg. F., 32 degree-days

It will be noted that the tests show a marked difference in demand and consumption between the two types of heating installations included in the investigation. Although no special effort has been made to find an explanation for this difference it is the opinion of the author that the answer simply lies in the fact that people with unit heaters do not attempt to keep *all* the rooms in the house as warm as do those who use the central furnace with air piped to each individual room. Furthermore, diversity of thermostatic control points on unit heaters is apparently the reason for the lesser demand on that type of installation as compared with the central furnace with its single point of control. In the event of extremely cold weather it seems quite likely that the thermostats on unit heaters in cold rooms would pick up the heaters and that the demand of the two types of heating under such conditions would closely approach each other.

Other Types To Be Tested

Since the tests were started, there have been a few baseboard and panel-heated residences added to the lines of the company and it is proposed to develop the load characteristics of these homes during the coming heating season in the same manner as the tests on central furnace and unit heater installations. A program for experimentation with reverse-cycle or "heat pump" equipment is now under consideration and it is probable that tests for homes heated in this manner will also be instituted by the company along with possibly other types of heating, to develop the fullest possible information on electric house heating.

Summary of Electric House-Heating Tests—Portland General Electric Co.

	Dec. 1945	Jan. 1946	Feb. 1946	Mar. 1946	April 1946	May 1946	June 1946	Total to Date
Monthly Minimum Temperature—°F.	26	28	31	33	35	45	50	.....
Degree Days	699	695	567	541	368	137	119	3,126
Number of Houses Under Test								
Central Furnaces	9	12	22	19	20	20	22	.....
Unit Heaters	17	29	31	31	29	27	29	.....
Average Cubical Content per House								
Central Furnaces	10,900	10,333	10,311	10,694	10,401	10,450	10,310	.....
Unit Heaters	11,020	10,095	10,058	10,077	10,425	10,079	10,091	.....
Average Number Kw.-Hr. per House								
Central Furnaces	2,870	2,777	2,310	2,006	1,608	465	343	12,379
Unit Heaters	2,180	2,209	1,783	1,498	1,236	328	294	9,528
Average Max. Coincident Demand								
Central Furnaces	10.6	8.6	8.9	9.4	9.1	6.7	4.0	.....
Unit Heaters	7.3	6.2	6.0	5.4	5.1	3.1	2.3	.....
Average Max. Non-Coincident Demand								
Central Furnaces	11.5	11.2	11.4	11.5	12.4	11.6	11.2	.....
Unit Heaters	10.3	10.3	10.0	9.0	8.6	6.1	5.4	.....
Calculated Cost—Schedule 9 Average Dollars per House								
Central Furnaces	27.00	26.88	22.46	20.39	16.54	6.69	5.47	125.43
Unit Heaters	20.73	21.20	17.05	14.10	11.33	2.58	1.98	88.97
Average Cents per Kw.-Hr.								
Central Furnaces	0.94	0.97	0.97	1.02	1.03	1.44	1.59	.....
Unit Heaters	0.95	0.96	0.96	0.94	0.92	0.79	0.67	.....

Modern Secondary Adequate
For Coming Home Loads

Analysis of systems serving 10 kva. per 1,000 ft. shows full adequacy to serve even heat-pump house-heating without resort to 3-phase or 240/480 volts or conductor larger than No. 2

D. K. BLAKE, *Engineer, Central Station Engineering Divisions, General Electric Co.*

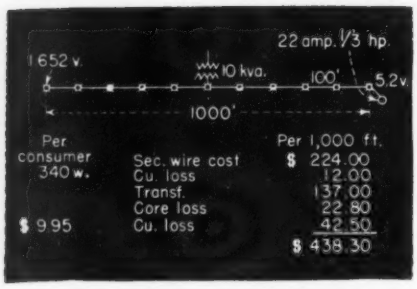


FIG. 1—Secondary system designed for 10-kva./1,000-ft. present load and 15-kva./1,000-ft. future load. Not practical where flicker is objectionable

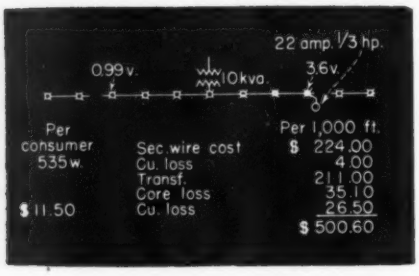


FIG. 2—A design limit of 3.6-v. flicker is obtained at lower cost by shorter secondary. Obviously this system has inherent greater load carry ability created by this expenditure for flicker correction

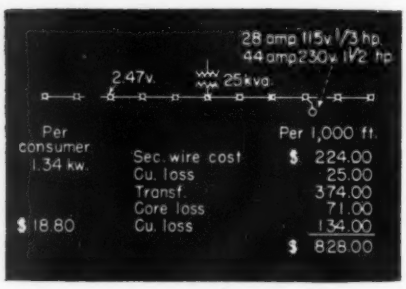


FIG. 3—After flicker is corrected no new transformer locations are needed until a 25-kva. transformer is loaded to its limit

FROM TIME TO TIME the fear is expressed that a wholly new type of secondary distribution will be needed if the anticipated heavy residential loads are to be served satisfactorily and at reasonable cost. Those who are dubious seem not to realize (1) that the present secondary distribution system is truly a low cost system and (2) that it is generally adequate for whatever residential loads may come. Further, there seems to be little, if any, occasion for use of conductor larger than No. 2. Nor does it appear that 3-phase secondary is going to be necessary nor the voltage raised to 240/480.

This all comes about because of the inherent elasticity of the secondary when viewed in terms of transformer size and spacing and the possibilities of banking often afforded.

The subject of secondary system economic design for load densities up to 100 kw. per 1,000 ft. was approached and solved at least 25 years ago. Many engineers of many systems with widely diverging conditions and costs have come up with substantially the same answer. Nothing is better established in distribution system economics on a sure economic footing today than the factors governing secondary system design.

The first factor is that the conductor size should be small like No. 2, No. 3 or No. 4. The second factor is that the chosen size wire stays put and the load growth is provided for simply by increasing transformer sizes and locations. A corollary to these two basic facts is a third one that for load densities now existing, a change in wire size cannot be justified even if the existing wire in place is a number six. The reason for the latter is the large number of services to disconnect and reconnect.

Single-phase, 120/240-volt, No. 2 secondary wire is fully adequate for domestic loads of the future even if house-heating should prove to be used extensively. A 75-kva. transformer overloaded 50 percent feeding one span of 125 ft. each way is equivalent to a load density of over 30,000 kw./sq. mile if the secondary mains are 300 ft. apart.

In order to emphasize adequacy of load-carrying ability, above 100 kw. per 1,000 ft. a step-by-step procedure will be discussed. The problem will be oversimplified by certain assumptions:—

1. Loads balanced line-to-neutral.
2. Loads equally divided on each side of the transformer.
3. Primary conductors already available wherever transformer is to be located.
4. There are four consumers on each pole.

These assumptions do not represent the facts in the field as everyone knows, but it is not unreasonable to assume them because it is so easy to correct for them at any step.

A load density of 10 kva./1,000 ft. is a very common one for light load areas. No. 2 wire is the one found to be most economical in the greatest

number of cases. If one were to put up a new secondary of No. 2 wire, Fig. 1, a 10-kva. transformer could be installed and still have room for growth to 15 kva. per 1,000 ft. or from 227 watts to 340 watts/customer transformer demand, allowing 50 percent overload on the transformer.

If, however, 3 percent voltage dip is considered the maximum allowable for frequent starting of motors, this system cannot be used because the motor produces a drop of 5.2 volts. If the secondaries are tied together or banked this transformer size and spacing can be used. Otherwise, the design must be for a lower impedance and this means either larger copper, or larger transformers or less length of secondary. Since there is 1.2-volts drop in the transformer and 4 volts in the secondary, the lowest cost will be obtained with a shorter secondary.

So, in Fig. 2, it is seen that $1.55/customer must be added to correct for flicker. When that is done there is automatically produced a system that will carry 535 watts per customer or more than double the existing 227 watts per customer. The load can be doubled without spending another nickel in this part of the system.

When the load on the transformer grows to be 15 kva. there is encountered the first limitation requiring further expenditures for transformers. The voltage drop at the end of the secondary or the third pole at that time is only 0.99 volts whereas we can allow 3.6 volts. So the next step is to increase transformer size successively until we reach a 25-kva. size.

The 25-kva. size will carry 37.5 kva. or 1.34 kw. per customer transformer demand (Fig. 3). Voltage drop is 2.47 volts—well within our limit, but too close to permit a larger transformer so the next step will require additional transformer locations and shorter secondaries. At this step, primary extensions become involved for the first time since correction has been made for flicker, load is now six times the initial customer demand.

After the new locations are obtained, transformer size can be increased up to 50 kva. before another limit is reached. At this time a thermal and a voltage limitation are reached simultaneously (Fig. 4). Consumer demand is now 3.75 kw.—well above a full-use customer of today. By this time, losses are beginning to assume importance. For the particular cost values chosen they are nearly equal to copper investment.

So, one is faced again with new primary extensions to new transformer locations. After this the transformer size can be increased to 75 kva. to reach another thermal and voltage limit giving, however, a system that will carry a demand of 9.4 kw. per customer. This is ample for full use plus heat pump, or air-conditioning or even some space heating. So, the No. 2 wire is adequate for a load growth from 227 watts to 9.4 kw. or forty times the assumed present per-customer demand. Observe that a 5-hp., 230-volt motor can be started frequently and keep within the 3.6-volt value.

When, however, this value is reached the limit of No. 2 wire from the thermal, voltage and economic point of view is also reached. The losses are now so high, it will pay to change to a larger size secondary wire like No. 2/0 and thus supply still larger loads. Neither would it be required to operate for very long near the thermal limit of No. 2 wire. Obviously, the 9.4 kw. is reduced by whatever degree of unbalance is found to be practical at such densities.

A similar analysis was made for 125-ft. pole spacing (representing 36 customers). This changes merely the time of the particular steps and the values of customer demands accordingly. Fig. 6 gives the successive step expressed in terms of customers, cost per kw., transformer investment and cost of all loses. It is observed that the cost per kw. levels off after the first step because the first step represents a much greater load increase

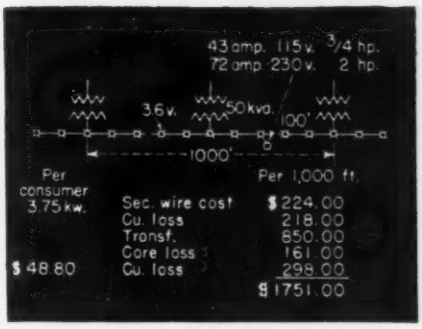


FIG. 4—The next location of transformers is adequate. 50-kva. transformers plus overload; at this stage larger starting currents are allowed

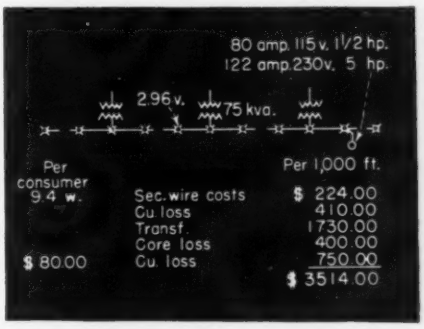
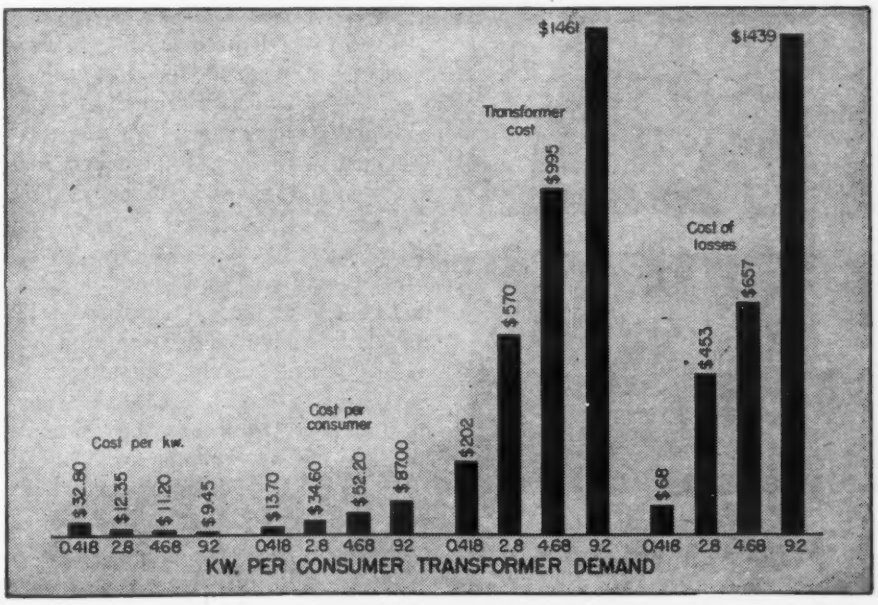


FIG. 5—The limit of No. 2 wire is finally reached when a 75-kva. transformer overloaded 50 percent feeds a distance of two spans

FIG. 6—The costs are here summarized for each step. Cost/kw. is compared with costs/consumer. Likewise transformer investments with total losses



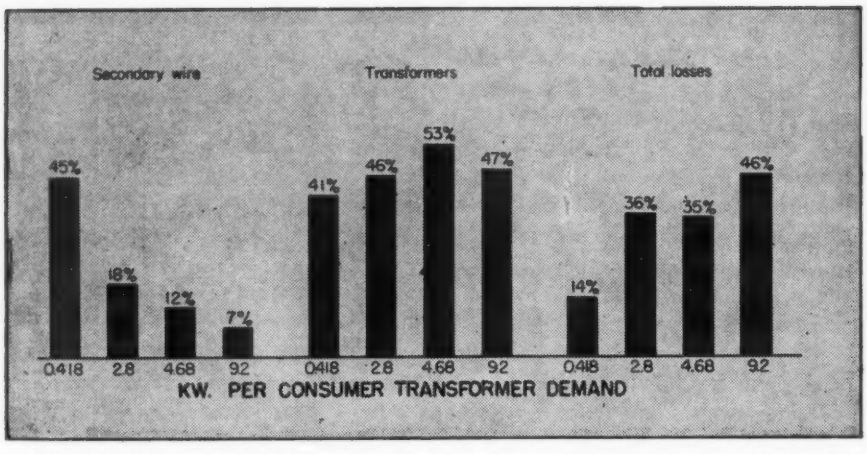
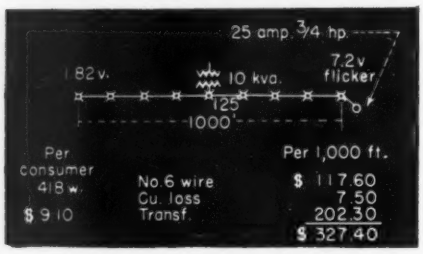
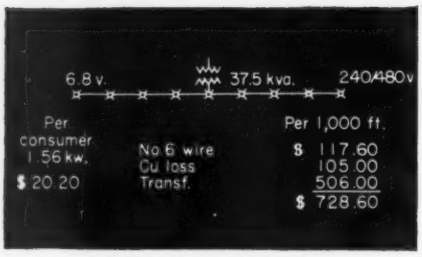
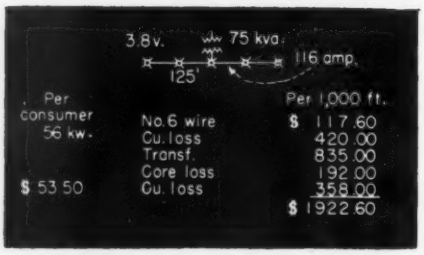


FIG. 7—Costs expressed in terms of percentage. Note the consistently high percentage for the transformer cost

than the later ones. The only expenditure for new equipment is in the transformers. This emphasizes the need for keeping transformer costs down. One way to accomplish this is by a rigid adherence to established industry standards.







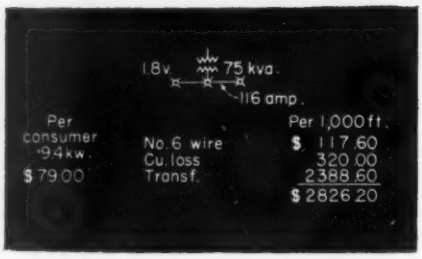


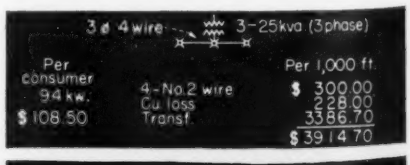
FIG. 8—A cost summary for 240/480 v. similar to the analysis for 120/240 v.

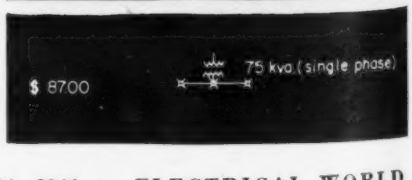
Fig. 7 is another way of looking at the cost elements of a secondary system. In the early stages, the losses are quite small and relatively unimportant and the secondary wire investment is a large part of the investment. In the later stages, the losses and secondary wire change positions in importance. The transformer investment is a large part of the total throughout all stages varying between 41 percent and 53 percent of the total. The fact that the losses assume greatest importance at the last stage is due to reaching the thermal limit of No. 2 conductor. Obviously, a lower evaluation of losses only makes the transformer assume a much greater importance. The best way now known to cut secondary system cost to build future loads is obviously to keep transformer cost down and that is done by the highest degree of standarization possible.

From time to time, the suggestion is made that a 240/480-volt system would show substantial savings over a 120/240-volt system. An analysis was made to show just how much this might amount to and is summarized in Fig. 8. Obviously, we save in the early stages by the use of the No. 6 wire instead of No. 2 and the fact that flicker voltage is no longer a basis for design. We can accept a ¾-hp. motor starting current without spending an extra nickel. At 5.6 kw. per customer, we run into the thermal limitation of No. 6 conductor. This is at an earlier stage than with 120/240 volts because the better voltage conditions permit a longer secondary with a 75-kva. transformer. The wire size does not need to be changed at this time because the transformer spacing can be increased. After this is done, we then need to change to a large size. We thus reach the same limitation and need for change in wire size for both voltage systems at the same time. The higher voltage system saves about $4 per customer initially and $8 per customer at the last stage. It is doubtful if this is enough to justify the use of the higher voltage system in view of its questionable safety from a consumer point of view.

Another frequent assertion is that 3-phase secondaries will be needed for these larger loads. This is analyzed in Fig. 9. The transformer cost goes up because there are three 25-kva transformers instead of one of 75 kva. Furthermore, one extra wire is needed for a 3-phase, 4-wire system. It is obvious that single-phase utilization would be lower in cost because a transformer on each pole (where it is possible) would be about $14 per customer lower. The next step shows that it pays to use secondaries and a larger transformer saving about $21 per customer over a 3-phase system. This extra cost of a 3-phase system is more than doubled when the cost of extra service wire and polyphase watthour meter is added. In this case, however, the utilization equipment consisting of 3 to 5-hp. motors would be substantially lower in cost with better performance and lower maintenance if it were 3-phase. Further study from the consumer aspect is needed to determine with finality, the overall system and consumer economics for 3-phase or single-phase utilization.

FIG. 9 — Three-phase secondary system is shown to be more expensive than single-phase. Also the benefit of secondaries in reducing transformer investments





Industrial Power Factor Corrected By

CURRENT CONTROL

Capacitor installation on 460-volt bus—Two of three banks controlled by line current—Grouping averts moving for building and manufacturing changes

GEORGE KOHLWEILER, *Philadelphia, Pa.*

AS A RESULT of a preliminary investigation an eastern industrial plant was found to be operating at 78.8 percent power factor with a load of 725 kw. and 566 reactive kva. The demands, however, were higher than the above load indicated. For example, several months previous the demand was 845 kw. and approximately 40 percent increase in load was anticipated. Under these conditions it was decided to install 450-kva. condenser capacity for improving the power factor to a minimum of 90 percent.

A total capacity of 450 kva. was installed in three groups of box type, explosion-proof (chlorinated-diphenyl) capacitors on 460-volt, 3-phase, 60-cycle bus. Each group of 150 kva. was mounted on angle-iron structure and electrically connected through 4-in. square duct.

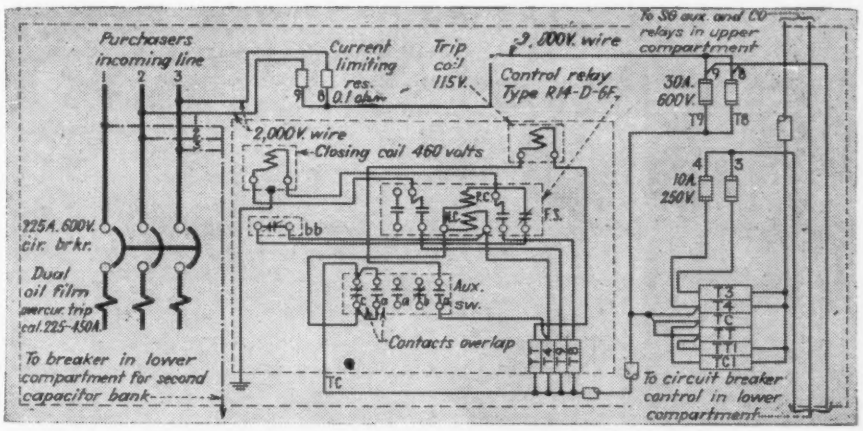
Two groups are electrically controlled by line current variation. For each, the control consists of one cubicle divided into three compartments. Both the bottom and middle compartments contain one 225-amp., 3-pole, 3-coil breaker equipped with overload protection and instantaneous trip. The top compartment contains the control relays, one for each breaker for solenoid operation. The current transformer for each breaker is so arranged that one breaker will throw its capacitor on or off the line at about 650-amp. line current and the second breaker will throw its capacitor on or off the line at about 450-amp. line current. Accompanying diagrams show the scheme of control connections for the middle compartment of the cubicle.

The third group of capacitors is manually controlled by one 225-amp., 3-pole, 3-coil circuit breaker equipped with overload protection and instantaneous trip.

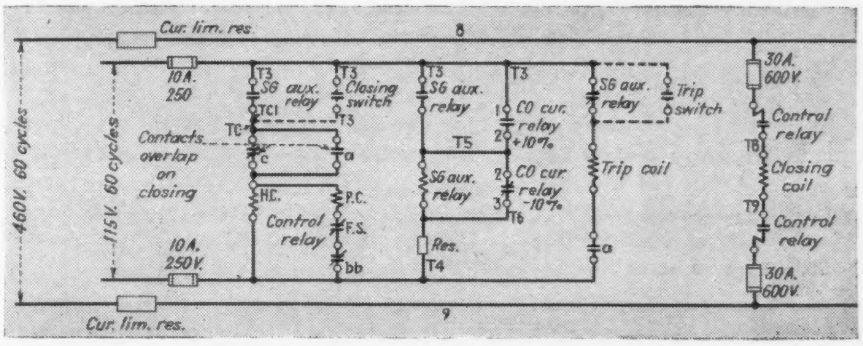
Estimated saving through power factor correction on a registered demand of 845 kw. and power consumption of 325,000 kw.-hr. amounts to $185 per month and, of course, with an anticipated increase in load the saving would be proportionately greater. The approximate cost of this installation, including labor and material, was $4,500.

Group Arrangement

By locating the equipment on the low-voltage bus the transformer was relieved of abnormal magnetizing current, thus reducing its loading, releasing capacity for additional loading, reducing losses and improving voltage. Although additional benefits could have been derived by dividing the total kva. among various branch feeders, it was thought advisable that due to building rearrangement, necessitated by change in methods of manufacture, the continuous moving around of these capacitors, as well as the method of control, would have complicated matters to quite a considerable extent.



SCHEMATIC CONNECTIONS in middle compartment of control cubicle



SCHEMATIC DIAGRAM of control for circuit breaker. Auxiliary switches function as follows:

- **(a) Closed when breaker is closed, open when breaker is open**
- **(b) Closed when breaker is open, open when breaker is closed**
- **(c) Open when breaker is closed. Remains open when breaker opens on overcurrent trip. Closes only when breaker is opened by shunt trip coil or manual trip**
- **(bb) Closed when breaker is open. Opens momentarily at end of closing stroke**
- **(FS) Contact closed when relay is deenergized. Contact closed when both pick-up coil (P.C.) and holding coil (H.C.) are energized. Contact open when holding coil is energized and pick-up coil is deenergized**

POLES SEASONED QUICKLY *in Hydrocarbon Atmosphere . . .* 1

New step in preservation process greatly shortens period for drying poles preparatory to impregnation—Wide variety of inexpensive distillates available—Details of the new procedure

MONIE S. HUDSON, *Chemist, Taylor-Colquitt Co., Spartanburg, S. C.*

A NEW PROCESS for quickly preparing wood for preservative treatment eliminates the strength reduction of the order of 20 percent reported for Southern Pine timber prepared for preservative treatment by current methods of practice.

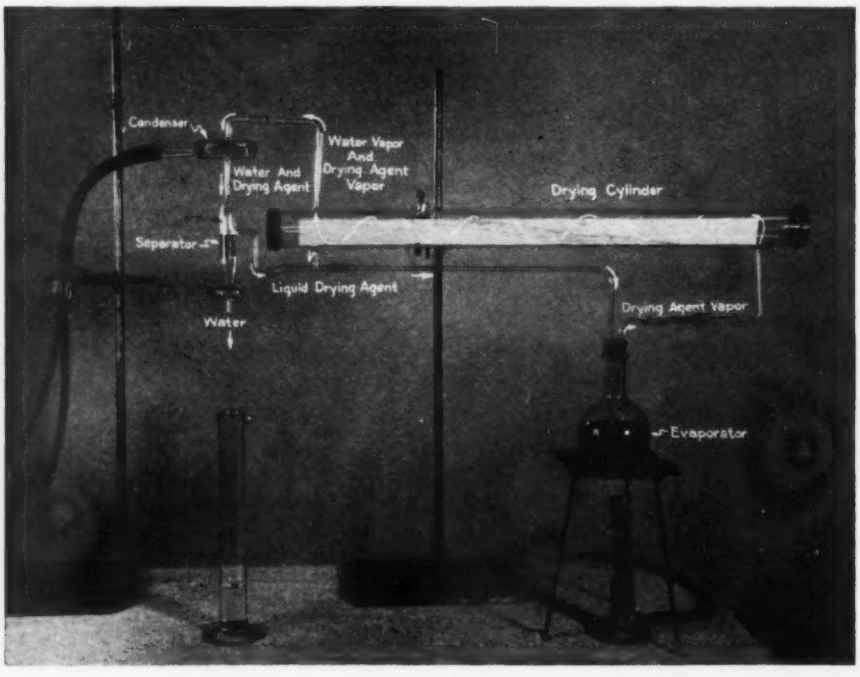
Pole users were more or less alarmed by the findings of Buckman[1] who made a study of the effect of steaming on the strength of Southern Yellow Pine, and Richards[2] who worked on the effect of so-called yard seasoning fungi on strength values of this timber.

The new process which has been given the name Vapor Drying is a development of the Research Laboratory of Taylor-Colquitt Co. at Spartanburg, S. C.

Spurred on by the impetus given research in timber drying by the reports of Buckman and Richards a number of companies in the wood preserving industry inaugurated research projects aimed at overcoming the strength reductions reported. For the most part these efforts were limited to the adaptation of existing methods of drying wood to the drying of poles. Departing from this conventional line of attack the inventor of the Vapor Drying Process directed his efforts toward development of a method whereby the timber could be dried not only without impairing the strength but also without requiring the long drying cycles that are inherent limitations of low temperature processes like kiln drying.

Since high temperature is one of the prime requisites for rapid drying, this worker recognized that by some means it would be necessary to utilize high temperature but without incurring the generally accepted penalties of its use; viz, strength loss and other detrimental effects. From critical examination of the effects of high temperature drying he concluded that injury to the wood was not produced purely from thermal action but was the result of the chemical action of the oxygen and water that have ever been present and disregarded in efforts made toward drying at high temperature.

FIG. 1—Laboratory model of Vapor Drying principle. Water distilled from green wood condensed, separated and discharged; condensed drying agent returns to evaporator for recirculation



Heat Transfer Rate

Recognition of this fact immediately indicated, as one of the adjuncts of high temperature of drying, exclusion of these substances from the presence of the wood while it was at high temperature, which suggested an operation carried out in an inert atmosphere such as nitrogen or car-

[1] Buckman and Rees; Effect of Steaming on The Strength of Sou hern Yellow Pine: I AWPA Proc. 1938 P-264; II AWPA Proc. 1940 P-331.

[2] Richards; Effect of P. Gigantea and S. Commune on S.rength of Southern Yellow Pine Sapwood: AWPA Proc. 1940 P-24.

bon dioxide. However, examination of the heat transfer rates obtainable with such fixed gases even at high temperature indicated that rather long drying periods would still be required to remove the large quantities of water present in green wood even when very rapid circulation of the gases was employed. Immersion in inert liquids such as creosote while heating was also considered but discarded because of the low rates of heat transfer characteristic of such heating and other objectionable features such as the high retention of preservative that occurs when the timber is dried while submerged.

At this point after examination of existing information on heat transfer to wood in drying revealed that the highest rates were obtained with steam it was concluded that the answer to the problem of rapid high temperature drying probably lay in the use of a condensing vapor to obtain the highest heat transfer rate, and one which at the same time would not attack the wood at high temperatures as does steam. Acting on this premise it was found that wood could be dried at very high temperatures without detrimental effects by exposing it to vapors of a large number of organic compounds such as hydrocarbons, alcohols, ethers, etc.

Principle of the Process

At this stage in the development of the Vapor Drying Process experiments were carried out in the laboratory (Fig. 1). The drying agent in the spherical flask is boiled by applying heat to the flask and the vapor from the boiling liquid is led into the long cylindrical vessel containing the wood to be dried. The hot vapor envelopes the wood and heats it causing the water that it contains to be vaporized. As rapidly as the water is vaporized it is displaced from the cylinder by the flow of incoming drying agent vapor which transports it to the condenser shown above the cylinder at the left.

The condensate formed by cooling the mixture of drying agent and water vapor passes downward into the cigar-shaped separator where the water settles to the bottom. The drying agent overlying the water returns to the boiling flask through the line connecting these vessels, along with any drying agent that has condensed in the cylinder. The water is removed at intervals through the stop cock at the bottom of the separator.

Throughout the period of heating in vapor the system is under atmospheric pressure being vented to the atmosphere through the open line on the upper left side of the separator. Although the system is open to the atmosphere at this point, the presence of air in contact with the highly heated wood which would cause injury by oxidation is effectually prevented by the barrier of drying agent vapor that fills the system up to the condenser. The vapor of most of the substances used as drying agents is five to ten times heavier than air so that the air is completely displaced from the system.

The only water vapor present in the system is that being vaporized from the wood and since the density relation between water vapor and drying agent is approximately the same as that between air and drying agent the water vapor is displaced from the cylinder as rapidly as it forms. This action is further promoted by the active flow of drying agent through the system which sweeps the vaporized water along to the condenser. In this manner the wood is protected from the two chief offenders which

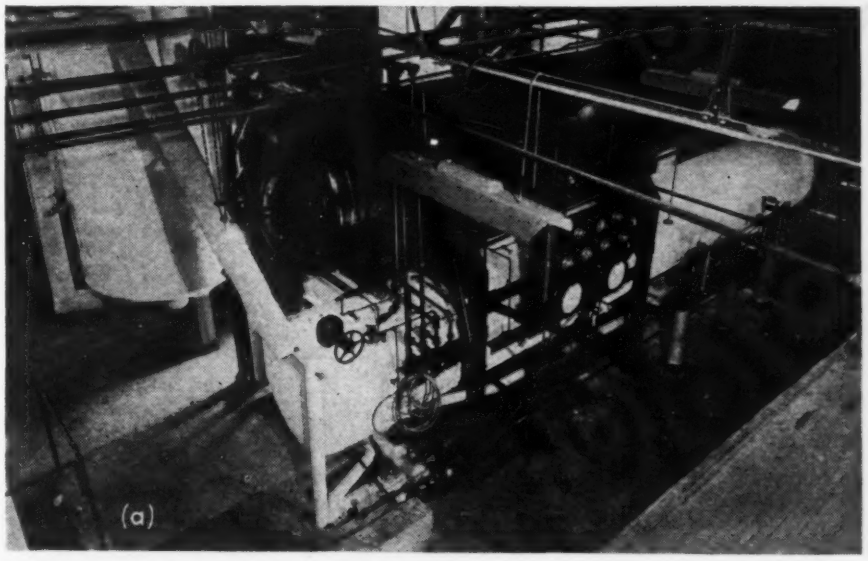
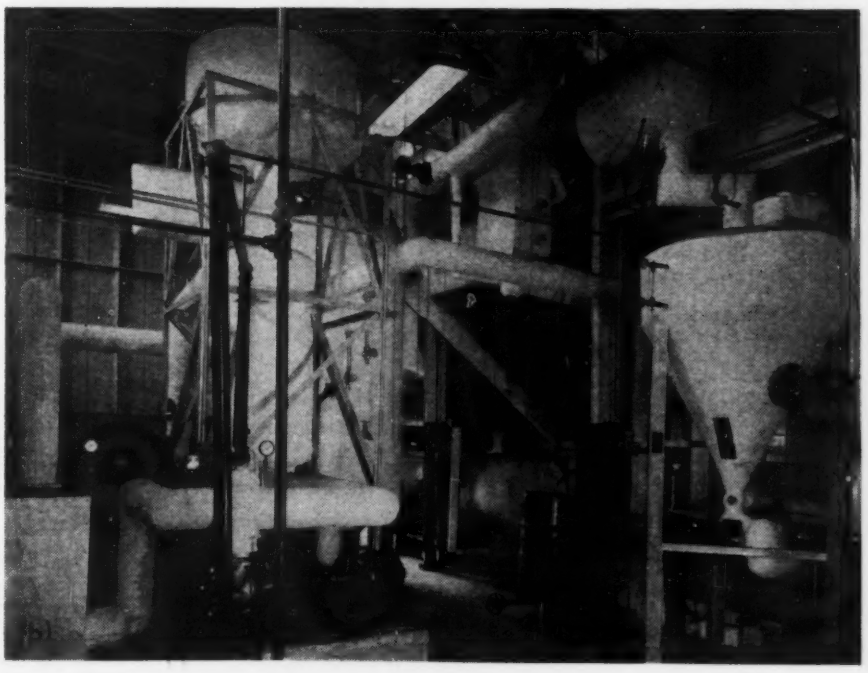


FIG. 2—Semi-commercial vapor drying plant has 26- x 3-ft. cylinder mounted on scales. (a) Rueping tank on top, evaporator in left background. (b) Inclined pipe is vapor discharge line to condenser near roof trusses; separator is cone-shaped vessel at extreme right



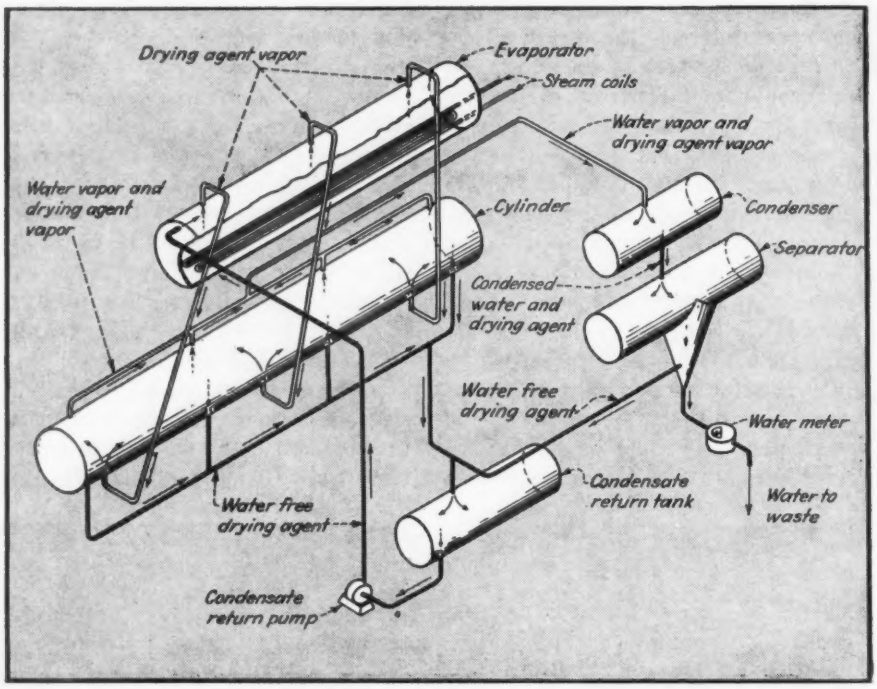


FIG. 3—Flow of the drying agent through the system, as indicated by the arrows, begins in the evaporator where the drying agent is vaporized by means of steam coils. The vapor thus generated flows into the bottom of the cylinder through the three diagonally descending vapor distribution lines. As this vapor rises in the cylinder it heats the wood and vaporizes the water from it. The water as soon as it is vaporized is displaced upward by the flow of drying agent vapor and discharges from the top of the cylinder through the four vapor discharge lines into the vapor discharge manifold. From this manifold the vapor mixture of water and drying agent passes into the condenser where cooling produces a liquid mixture of the two. This liquid passes from the condenser to the separatory tank where a gravity separation into an upper layer of drying agent and a lower layer of water occurs. The liquid drying agent passes continuously from the separatory tank into the condensate return tank while the water discharges from the system through the water meter indicated. In the condensate return tank the liquid from the separatory tank is joined by any condensed drying agent from the cylinder and is pumped back to the evaporator where it vaporizes again to begin another circuit through the system. The progress of the drying may be ascertained at any time during the operation by observing the amount of water removed from the charge as shown by the water meter

attack wood when it is subjected to high temperatures, viz, air which produces degenerative chemical changes in the cellulose and lignin by oxidation, and steam which produces these changes through the chemical reaction with these wood constituents that is known as hydrolysis.

Pilot Plant

After tests in this laboratory equipment had demonstrated the workability of the process a small pilot plant was constructed. Among the substances included in the glassware stage tests to determine which were suitable as drying agents were a number of the lower boiling fractions from coal tar creosote that showed themselves to be well suited for the purpose, and since the finished product would contain creosote these fractions were used in the small pilot plant for determining optimum temperature range for drying, drying rates, treatability of the wood after drying, etc. In these tests it was found that fractions boiling in the temperature range between 212 deg. F and 400 deg. F gave very rapid drying without injuring the wood and subsequent impregnation yielded excellent penetration and distribution of preservative.

Semi-Commercial Plant

In 1942 a semi-commercial pilot plant equipped for operation of both vapor drying and pressure impregnation in the same cylinder was erected based on design data obtained in operation of the small unit. The cylinder which is 26 ft. in length by 3 ft. in diameter has associated with it complete facilities for vapor drying as well as the latest in equipment for operating any type of impregnation procedure.

Over a period of three years the new process was rigorously tested on various species of wood including soft woods such as Southern Pine, Douglas Fir and Western Hemlock, and hardwoods such as Oak, Gum, Beech, Birch, Maple and Hickory; in the form of poles, piling, crossties and bridge timbers. From the start the results of these tests showed conclusively that high temperature drying could be successfully operated when carried out in the presence of organic substances in vapor phase that were inert with respect to chemical attack on the wood.

Drying Agents

Scores of compounds were examined in this work for their suitability as drying agents, particular attention being given to their commercial availability and cost. As a result of this work a large number of low cost materials were found from which a drying agent required for a specific job may be selected. For example, a plant wishing to vapor dry pine poles for preservative treatment with creosote would select a coal tar distillate similar in composition to creosote as the drying agent. Choice of the particular coal tar fraction selected would be governed to some extent by the steam pressure available at the plant for boiling the drying agent. If the working steam pressure available were 150 psi. any of the materials boiling in the range 212 to 320 deg. F might be used. Such a plant, however, would not be excluded from the use of drying agents boiling above 320 deg. F, because by conducting the drying under vacuum the boiling point of higher boiling materials may be lowered to the available operating temperature. A fraction boiling above 450 deg. F could under a 24-in. vacuum be made to boil at about 320 deg. F if desired. Again, should the postulated plant require a drying agent for processing lumber for interior use where the traces of a coal tar drying agent left in it would be objectionable a suitable compound

would be selected from the group of odorless petroleum fractions available, or from among the various hydrocarbons, alcohols, ethers or ketones that have been found to be suitable as vapor drying agents. A comprehensive list of these vapor drying agents will be found in U. S. Patent 2,273,039.

Full-Scale Operation

Within the past year the Vapor Drying Process emerged from the development stage with the construction and successful operation of a full-sized commercial plant. Because the process was originally conceived in searching for a means to prepare wood for preservative treatment considerable attention was given toward evolving elements of apparatus and of operating technique that centered around the impregnating cylinder as a nucleus. Consequently when the process was brought into the commercial stage the vapor drying equipment was added to a creosoting unit of the conventional type with a minimal requirement in labor and materials. The cylinder used in this conversion was 8 ft. in diameter by 115 ft. long.

Since the Rueping tank associated with the cylinder was converted into a boiler or evaporator for the drying agent the only additional pieces of equipment required for the conversion were the condenser, separatory tank, condensate return tank and condensate return pump. The accompanying Fig. 3 shows the arrangement of the various elements in this commercial installation.

Conditions existing in the cylinder during a typical drying operation followed by preservative treatment using the empty cell process are shown in Fig. 4.

A typical cycle for vapor drying and impregnation of pine poles having a midpoint diameter of eight inches, and an initial moisture content of 90 percent is indicated in Figs. 3 and 4. The final moisture content of poles thus treated will be approximately 35 percent. For poles having diameters in the range six to eighteen inches about one hour vapor drying per inch of diameter is required for a moisture reduction of 55 percent. For smaller diameters the time requirement decreases very rapidly, while for larger diameters it gradually increases.

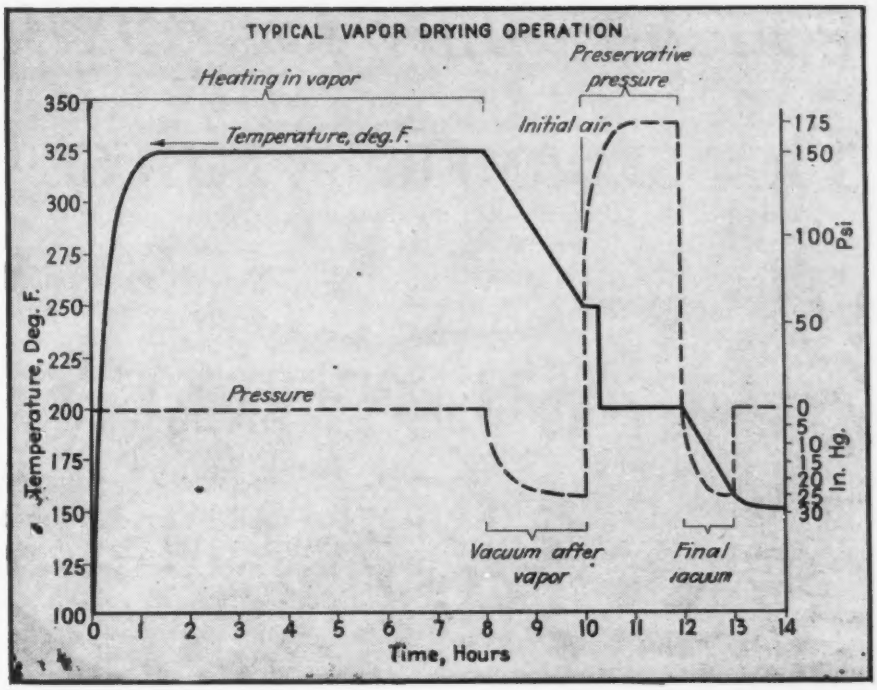


FIG. 4—During the first hour, entry of vapor from a coal tar fraction boiling at 330 deg. F. in the evaporator raises the cylinder temperature rapidly to a point approximately the same as that existing in the evaporator. The cylinder temperature is then maintained at that point for seven hours by circulation of vapor through the system as already described. The pressure existing in the cylinder throughout this stage is atmospheric. At the end of the heating period the wood which is now adequately dried for preservative treatment contains a considerable amount of condensed drying agent that it has absorbed while losing water. Application of the vacuum after heating in vapor volatilizes this drying agent which is later recovered.

In the usual operation about ½ lb. of drying agent per cu. ft. of wood is left in the charge at the end of the vacuum. Further reduction may be accomplished if desired by prolonging the vacuum. The remainder of the processing is carried out in the same manner as for air seasoned timber by applying 75 psi. initial air, followed by filling the cylinder with preservative and raising the pressure to 175 psi. in one hour and maintaining it there for an additional hour. In this particular case the impregnation would be carried out so as to leave a net retention of 7½ lb. of creosote per cu. ft. of wood, if the treatment specification required 8 lb. per cu. ft., the additional ½ lb. per cu. ft. having been left in the wood at the end of the vacuum after vapor drying. After a final vacuum of one hour the charge is removed

Ventilation of Thermal Circuit Breakers Improved

JOSEPH W. ST. ANDRÉ

Maintenance Supervisor, Wright Aeronautical Corp. Wood-Ridge, N. J.

WHEN INSTALLED one above the other (stacking), metal-clad thermal circuit breakers often have the disadvantage of having the top or uppermost unit troubled by the accumulated heat of the breakers beneath.

At the Wood-Ridge, N. J., plant of Wright Aeronautical Corp. it was found that the ventilating slots in the back of the metal-clad 225-amp. air circuit breakers did not provide sufficient ventilation for normal heat dissipation. The breakers were mounted three high and the temperature of the top breaker became abnormally high as a result of the undissipated heat of the two lower units.

Improved ventilation of the enclosure was obtained by the simple means of cutting two slots approximately 3x8 in. in the top and bottom of the front panel of each breaker. These openings were then covered with a piece of expanded metal mesh.

The temperature of the enclosures was thus lowered. This has eliminated the premature tripping of the top breaker's thermal element.

Which Supply for Auxiliaries . . .

TRANSFORMER or HOUSE GENERATOR?

H. W. EALES.* *Electrical Engineer, Public Utility Engineering & Service Co., Chicago, Ill.*

An examination of the auxiliary power supply systems of four recently constructed stations or additions—two using station auxiliary transformers and two using house service generators. Switching schemes described and performance tests cited; costs compared

WHETHER house service generators or station auxiliary transformers are to be used as the source of auxiliary supply and what switching scheme best serves the paramount design objectives of reliability, simplicity and convenience are fundamental problems upon which there is some difference of opinion.

As a contribution to the general subject of auxiliary power supply this article will describe the station auxiliary service systems of four recently constructed generating stations or extensions.

Stations whose auxiliary power supply systems will be described are: Silvergate Station, San Diego Gas & Electric Co.; Paddy's Run Station, Louisville Gas & Electric Co.; Frank R. Phillips Station, Duquesne Light Co. and Unit 4, High Bridge Station, Northern States Power Co. Station auxiliary transformers were used at Silvergate and Paddy's Run while at Phillips and High Bridge No. 4 shaft-driven house service generators were employed.

Station Auxiliary Transformers

Simplicity and reliability of the transformer and the fact that it is stationary have made it a popular choice for supplying station auxiliary power, particularly when connected directly to generator leads. Its use permits reduction in the length of main turbine units, compared with house service generators, and it minimizes the task of maintaining alignment of a multi-section shaft. However, use of an auxiliary supply transformer does not utilize the excess margin of capacity in steam turbines, as does a house service generator. It was to accomplish this in cases where auxiliary transformers were used, that over-size main generators were selected for the Silvergate No. 2 and the Paddy's Run, No. 3 units.

At Silvergate Station in San Diego, all high-tension buses, circuit breakers, transformers and related apparatus are located in an outdoor station switchyard. Station auxiliary power supply operates at 2,300 volts. Two 3,000-kva., three-phase 12.5/2.4-kv. transformers, located in the outdoor switchyard, supply the principal auxiliaries. One transformer (Fig. 1) is in effect connected to leads of the 43,750-kva. No. 1 generator through an outdoor 12.5-kv. circuit breaker while the other transformer is applied from the main bus of the 12.5-kv. substation in the station switchyard.

All principal auxiliaries are in duplicate; one-half being supplied from one section of the 2,400-volt supply bus and the other half from the second section. Each transformer normally supplies only one-half the auxiliary load since the bus-tie breaker is normally open. Upon failure of supply from either transformer, a voltage chasing scheme, set in operation by the opening of either 2,400-volt transformer breaker (3 or 5 in Fig. 1) will cause the tie breaker (4) to close instantly, provided this is not restrained by other protective devices that would function in case of bus section fault. From this it is seen that any two of the 2,400-volt breakers may be closed simultaneously *but not all three.*

All auxiliary motors under 50 hp. are supplied from a 240-volt system that is fed from both 2,400-volt bus sections. Feeders from the two bus sections each supply a 750-kva., three-phase 240-volt transformer and a 100-kva. 240/120-volt single-phase transformer. These transformer pairs are located outdoors at opposite corners of the station building. A connection from each goes to five independent load centers scattered through the station whence radial feeders run to various motor groups.

Reserve Transformer Used

Paddy's Run station at Louisville contains two 25,000-kw., 35,700-kva. 0.7-pf. 14-kv. 3,600-rpm. hydrogen-cooled turbo-generators with direct-connected main and pilot exciters. Station auxiliary supply for the new 50,000-kw. No. 3 turbine unit is equipped with an oversize generator (60,000 kw., 75,000 kva.) (Fig. 2.).

Power for starting up is taken from a station 14-kv. bus through a 5,000-kva. "reserve" transformer (A in Fig. 2.). After auxiliaries and main steam generator are up to speed the auxiliary load is thrown over to the 5,000 kva. transformer (B) connected directly to the generator leads without a breaker.

Closing breaker No. 1 automatically causes breaker No. 3 to open instantly. In the event of the subsequent automatic tripping of breaker No. 1 for any cause, a voltage chasing scheme instantly closes breaker No. 3, thus retaining power supply to the 2,300-volt buses. Since bus-tie breaker No. 2 is normally closed, it follows that all auxiliaries may be carried either by the generator's own supply transformer (B) or from the

*Based on paper before EEI Electrical Equipment Committee, Chicago, May 7, 1946.

system transformer (A) but not from both. This is quite different from the normal operating procedure followed at Silvergate where each of the two transformers carries one-half of the 2,300-volt auxiliary load.

Connections and procedures fundamentally identical with that for 2,300-volt auxiliaries were used for the 440-volt auxiliaries through transformer sub-banks (C and D).

House Service Generators

The purposes served by house generators are two-fold: (1) To provide an efficient source of power independent of outside system disturbances and (2) to permit full practical utilization of all marginal capacity incorporated in the steam turbine under purchase specifications. In the cases cited there is a 25-percent excess margin of capacity over and above nameplate rating at specified conditions of steam pressure, temperature and condenser back pressure.

At Frank R. Phillips station* of the Duquesne Light Co. a 6,000-kw. 7,500-kva. 2,400-volt house service generator supplies power for station auxiliaries. This generator is connected to the 60,000-kw., 75,000-kva., 3,600-rpm., 11.6-kv. hydrogen-cooled generator through a Bartlett-Haywood flexible coupling.

* Footnote: See also article "Frank A. Phillips Station" ELECTRICAL WORLD, October 16, 1945.

To achieve an auxiliary supply independent of system disturbances the connections shown in Fig. 3 were adopted. In this scheme all principal auxiliaries are in duplicate and divided evenly between two 2,400-volt bus sections. Starting up power is taken from a 7,500-kva. transformer bank supplied from an outdoor 22-kv. substation source. Referring to Fig. 3 auxiliaries are started by closing either breakers (1) or (3) or (1) and (3). When auxiliaries are at speed and carrying load and the shaft generator is also at speed and full voltage the generator breaker is closed automatically tripping system supply breakers and shifting load to the generator *without paralleling.*

Voltage Chasing

Interlocks and voltage chasing equipment absolutely prevent the house generator from ever being paralleled with the system at any time. Voltage chasing scheme control connections are so interlocked that the following combinations of breakers, controlling power supply to the 2,400-volt bus, may be closed at one time: (1) and (3) or (2) and (4)—or—(1) and (4) or (3) and (2) but never (1) and (2) or (3) and (4). Hence the shaft generator cannot be paralleled with the system. Transferring of load from system transformer to house service generator cannot be paralleled with the system. Transferring of load from system transformer to house service generator is accomplished by throwing over whole blocks of load at once.

Conference with the manufacturer's generator and motor designers and control authorities led to the conclusion that capacity of house generators should be not less than 10 percent of the kw. and kva. rating of the main generator.

Duplicate 2,300-volt feeders from 2,300-volt bus sections supply power to two banks of 2,300/460-volt trans-

List of 2,300-Volt Feeders For Bus Groups III and IV of Fig. 4

GROUP IV SEC. 1	HP.	GROUP IV SEC. 2	HP.	GROUP III SEC. 1	HP.	GROUP IV SEC. 2	HP.
Sub Banks	—	HWP	125	Bank No. 3	—	BFP	800
HWP	125	CWP	250	Sub Banks	—	IDF	700
CWP	250	ExH	100	IDF	700	FDF	350
BFP	800	Pulv.	300	FDF	350	ExH	100
ExH	100	FDF	350	ExH	100	Pulv.	300
Pulv.	300	IDF	700	Pulv.	300	CWP	200
FDF	350	BFP	1250	BFP	1250	HWP	125
IDF	700	Tie to		CWP	200	Tie to	
Tie to		Bank No. 2	—	HWP	125	Bank No. 1	—
Group III Sec. 2				Bus Tie	—		

FIG. 1—Station auxiliary supply system for Silvergate Station, San Diego . . . FIG. 2—Connections for 2,300-volt and 440-volt station auxiliaries for Unit No. 3 at Paddy's Run Station, Louisville. Units No. 1 and 2 have similar auxiliary power groups but the three groups are not interconnected . . . FIG. 3—Switching scheme used at Frank R. Phillips Station, Pittsburgh, permits supplying 2,300-volt auxiliary bus from either 22-kv. system of a house service generator but *not* from both simultaneously . . . FIG. 4—Diagrammatic connections of power supply for 2,300-volt power supply for 2,300-volt station electrical auxiliaries at High Bridge Station, Minneapolis

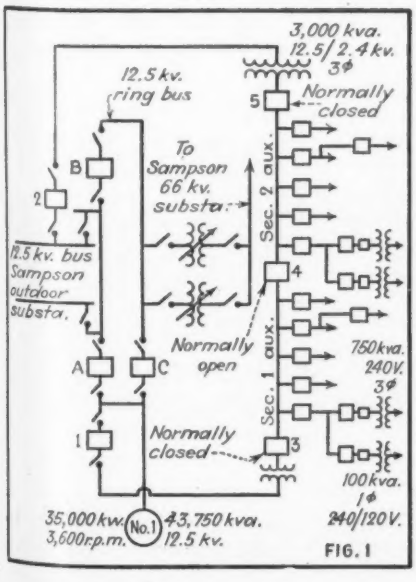


FIG. 1

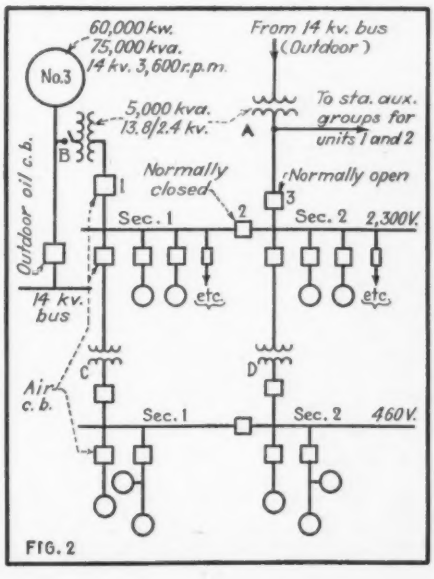
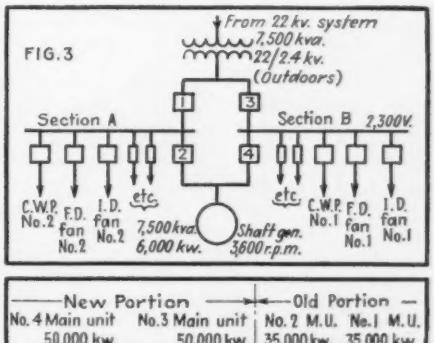


FIG. 2



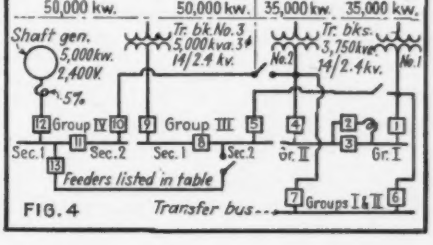


FIG. 4

formers that supply sections of a 460-volt bus in a manner identical with that used to convert the house generator and 7,500-kva. transformer bank to the 2,300-volt bus sections. Thus each group of auxiliaries may be fed from either the house service generator or the system but not simultaneously from both sources.

High Bridge Plan

The switching scheme originally adopted in a new station invariably influences the switching schemes employed in later additions. From an operating viewpoint it seems wise to adhere to a uniform switching scheme throughout any given station. However, when extensions overshadow the importance and capacity of the scheme originally adopted, there seems ample justification for changes in the original scheme, as was the case at High Bridge station.

Principal connections of the power supply for 2,300-volt electrical auxiliaries at this station are shown in Fig. 4. The old portion was constructed about 1924 and the new portion between 1941 and 1944. The latest unit, No. 4, is a 50,000-kw., 62,500-kva., 3,600-rpm. hydrogen-cooled generator solidly coupled both to the turbine and to a 5,000-kw., 6,250-kva., 2,300-volt house service generator.

While Fig. 4. shows the 2,300-volt bus and supply connections for all four main units in the station, the tabulated lists of 2,300-volt feeders apply only to the two new 50,000-kw. units No. 3 and 4. Each of these units is, broadly speaking, equipped with a duplicate set of auxiliaries and each is supplied from its own section of bus, i.e., Group IV, Sections 1 and 2; Group III, Sections 1 and 2. It will be seen that Group IV section 1 has a reserve connection through breaker No. 13 to section 2 of Group III and also from section 2 of Group IV through breaker No. 10 to transformer bank No. 2 associated with turbine unit No. 2 and that section 2 of Group III has a reserve connection through breaker No. 5 to transformer bank No. 1.

Operating officials of this company preferred in operating the house generator that it be paralleled with the system momentarily only: (a) When picking up station auxiliary load that has been started up by power taken from the system and (b) when auxiliary load is being transferred from the house generator back to the system supply.

This introduced temporary complications. For initial operations the manufacturer had set the rotor of the house service generator so that with no load on the main generator the house service generator would pick up one-half load upon being momentarily paralleled with the system. This resulted in the service generator rotor being set for a lead of 17½ deg. Following the observations of several tests the coupling was rotated backward giving the house service generator 27½-deg. lag with respect to the main generator. With the setting the worst condition would occur if load were transferred to the house service generator with no load on the main unit. This condition would be very unusual since turbine designers recommended that a fairly substantial load—one-third the maximum rating—be put on the turbines as soon as it is ready to go on the line.

Control Schemes Compared

Tests were conducted at Phillips Station and subsequently at High Bridge to determine the ability of the shaft-driven house service generator to start the largest motor of the 2,300-volt auxiliary power load with full voltage applied, when the service generator was either partly or nearly fully loaded.

The most severe test at Phillips was when all motor load except one 1,250-hp. 3,600-rpm. boiler feed pump motor was being carried by the house service generator. This motor was then thrown on the line with the service generator's voltage regulator intentionally removed from service. The result was that the motor started but the heavy starting current reduced the bus voltage to the point where the motor would not come up to speed. With the voltage regulator in service, however, no difficulty was experienced. Tests throwing full motor load from system to service generator or vice versa with voltage regulator functioning were entirely successful.

Tests at High Bridge station in which a 1,250-hp. 3,600-rpm. motor was started from the house service generator bus when that machine was well loaded (voltage regulator in service) corroborated the favorable results obtained at Phillips station.

Additional tests were made at High Bridge to observe performance when load was transferred from the house generator to the system supply bus under conditions simulating a service generator failure. This test caused some concern initially because, when the service generator was disconnected from the bus (manually) as though by differential relay action, four synchronous motors sustained voltage in the Group IV section buses for an appreciable time and prevented the under-voltage bus relay from causing a transfer. This transfer was further complicated by operation of other restraining relays which function in case of a bus fault. However, the transfer was made in due time but some of the synchronous motors tripped out through action over-current relays on current in rush. These relays are given higher settings and operation then proceeded as intended.

No difficulty of the latter type was experienced at Phillips because all motors at Phillips were of the induction type.

House Generator Costs

It was initially thought that adding a shaft-driven house service generator to the main unit at High Bridge would require additional building cost for increased length of turbine room and also that the shaft generator itself would be more expensive than an equivalent transformer, its switching and control equipment. Space required to remove the revolving field of the main generator, however, proved to be in excess of the space taken by the house generator and exciter combination. Thus it was not necessary to make any building charge against the house service generator.

From a cost standpoint, the extra cost of adding the 5,000-kw. house unit was about $7.00 per kw. Eliminating the 2,400-volt breaker and connections from the comparison as common to both the house generator and equivalent transformer installation, it was found that the purchase cost of a 5,000-kva. 14/2.4-kv. three-phase transformer (plus 14-kv. cable, two 14-kv. breakers for connection to the duplicate 14-kv. station buses) was a standoff. This fact, with apparent decided advantages to be derived from a house generator, resulted in selection of a shaft-driven machine.

SLIP CYCLE RELAYS

Automatically Separate Power System

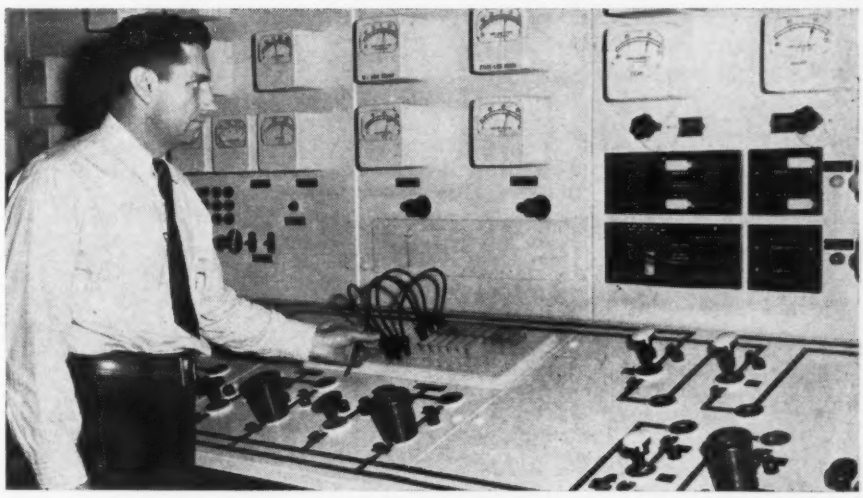
Relay system automatically separates transmission grid at predetermined points to allocate loads in relation to generating ability—major interruptions prevented

LLOYD F. HUNT, *Chief Electrical Engineer, Southern California Edison Co., Los Angeles*

MAJOR OUTAGES on the Southern California Edison system were eliminated many years ago by the use of automatic separation relays. This is a relay system that responds from slip cycles to actuate the tripping of the necessary predetermined breakers to separate and allocate loads in relation to generating ability. During conditions of transient stability on power systems there has always been the problem of trying to control the points at which separation takes place so that generating ability and loads would not be disproportionate, resulting in major interruptions.

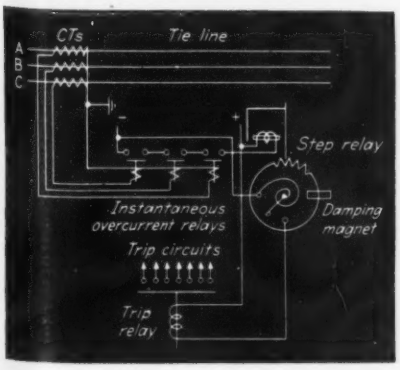
Under actual operating conditions it was found that when manual separation was used, even though an operator separated in 5 sec., the generators were so badly out of step that they could not take their proportion of load. As an instance, steam plant condensers lost their vacuum and turbines were unable to carry load until the condition was corrected. Generation on the Edison system is in three groups consisting of steam in the Los Angeles area; the Big Creek hydro plants, and at Boulder power plant. The 220-kv. system, being a power grid, is protected by relays that do not operate on out-of-step conditions. If such a grid did operate on out-of-step, there would be no way of controlling where it was tripped and it would be impossible to allocate loads according to generating abilities of the three power sources. Quite naturally many steps have been taken to prevent out-of-synchronization conditions, such as speeding up oil circuit breakers, reducing short circuit kva., etc., but it is still practically impossible to eliminate all out-of-step conditions by such measures.

Only the generating station that is out of step is automatically separated with its load. The accompanying diagram shows the principle involved and the protographs show the switchboard and relay installation at Lighthipe substation. The system consists of three instantaneous relays with their current coils connected respectively on A, B and C phases of the tie line between the generating sources. The contacts of these three elements are in series, which in turn actuate a step-type relay. The step relay is necessary because it must distinguish between a three-phase fault and an out-of-step condition. It is designed to close its contacts with two to five slip cycles with a period of one to seven slip cycles per second. These step type relays are actually set to operate on three slip cycles. The step relay energizes a multi-circuit auxiliary relay to trip as many breakers as necessary to effect separation.

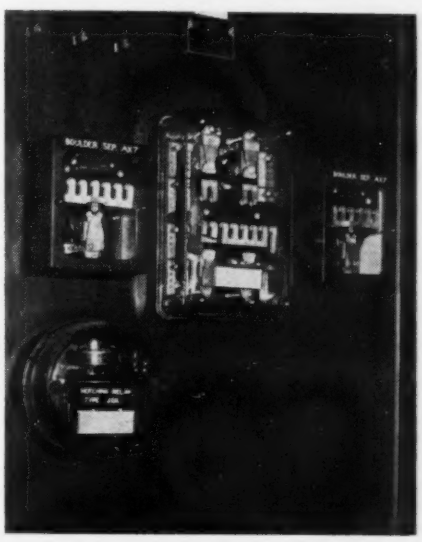


PANELS on switchboard where prearranged tripping schedule is set up for automatic system separation under out-of-step conditions. Panels are a miniature of actual station layout, thus enabling operator to check the separation set-up at a glance

ARRANGEMENT of separation relays showing connections of overcurrent, step and trip relays



RELAY BOARD installation of instantaneous over-current relay (center), step type or notching relay (lower left) and tripping relays



Commission Attitude on Removal Of Excess Profits Tax

R. N. LARKIN, *Washington Editor*, ELECTRICAL WORLD

IN THE SIX MONTHS first after the repeal of the excess profits tax, state regulatory commissions have shown themselves aware of the possibilities for rate reductions raised by its removal. At the same time regulatory bodies have shown themselves aware of the increases in operating costs which both preceded and followed repeal of the excess profits tax in 1945.

An ELECTRICAL WORLD survey of state regulatory commission thinking with regard to the possibility of rate reductions from the money made available by removal of the excess profits tax liability showed that 20 of 33 commissions reporting were considering this possibility. Two of 15 commissions which failed to report have issued public statements indicating that they are considering reductions based at least in part on tax savings. In four other states from which no reply was received, reductions have been achieved which may or may not have been based in part on the availability of revenues previously paid to the U. S. Treasury in excess profits taxes.

Only eight of the 33 reporting commissions stated that they were not considering this possibility. In seven of these states, however, there is no applicable state jurisdiction. Nevertheless, in four of the eight, reductions have taken place.

Five state commissions reported that they are studying the problem, generally through conferences. It was indicated the negotiations aimed at rate reductions would be used, where feasible, rather than formal rate cases. Four of the five commissions conducting their own studies mentioned the impact of cost increases upon the possibility of rate reductions through the repeal of the excess profits tax.

Four additional commissions disclosed that they have asked affected utility companies to undertake studies aimed at showing what revenues might be available for rate reductions because of the tax cut. The extent of these studies varied somewhat, with one commission asking all companies for little more than the nature of the 1945 tax liabilities and estimates of 1946 earnings, while others asked for complete studies with suggestions for rate reductions to accompany them.

Precisely what savings will accrue to electric utilities in 1946 as a result of the repeal of the federal excess profits tax will not be known for months to come.

An indication of the result, however, is to be had in the Federal Power Commission's appraisal of the problem in a study entitled "Effect of Income Tax Law Revisions on Electric Utility Taxes and Income, First Quarter, 1946." This study shows net income for the first quarter of 1946 to have been $195,617,000, an increase of $55,185,000 over net income for the corresponding quarter of 1945.

FPC estimated that "some $40,000,000 of the increase is accounted for by decreased taxes." Difference between tax accruals in the first quarter of 1945 and 1946 may not be indicative for the full year. Accruals in first quarter of 1945 were heavy. Later much advantage was taken of deductions for certificated "emergency facilities." Also, heavy refunding operations enabled large tax savings.

Class A and Class B Privately Owned Electric Utilities in the United States

Composite Statement of Revenues and Income

First Quarter

Item	1945	1946	Percent Change
Electric Utility Operating Revenues	$815,785,000	$819,842,000	0.5
Electric Operating Revenue Deductions:			
Operating Expenses	352,846,000	355,377,000	0.7
Depreciation	80,186,000	79,579,000	−0.8
Taxes	202,375,000	168,084,000	−16.9
Total Operating Revenue Deductions	635,407,000	603,040,000	−5.1
Net Electric Operating Revenues	180,378,000	216,802,000	20.2
Income from Electric Plant Leased to Others	1,233,000	1,234,000	0.1
Electric Utility Operating Income	181,611,000	218,036,000	20.1
Other Utility Operating Income	22,548,000	29,412,000	30.4
Total Utility Operating Income	204,159,000	247,448,000	21.2
Other Income	11,691,000	13,202,000	12.9
Gross Income	215,850,000	260,650,000	20.8
Income Deductions	75,418,000	65,033,000	−13.8
Net Income	$140,432,000	$195,617,000	39.3

Excess Profits Tax Record of the Electric Utility Industry

YEAR	PAYMENTS (U. S. TREAS.)	ACCRUALS* (FED. POWER COM.)	PAYMENTS* (E. E. I.)	PERCENTAGE OF INDUSTRY** (FED. POWER COM. ESTIMATE)
1940	$979,000	Not available	$6,000,000	40 companies***
1941	$ 39,460,000	Not available	$ 47,000,000	Not available
1942	$101,320,000	$128,693,000	$133,000,000	98+
1943	Not available	$178,527,000	$188,000,000	98+
1944	Not available	$182,024,000	$186,000,000	98+
1945	Not available	$168,390,000	$173,000,000	98+

* *Electrical operations only.*

** *Based on reports of 225 Class A and B utilities and expanded to all Class A and B utilities representing 98+ % of the privately owned electric power industry.*

*** *U. S. Treasury figure.*

REDUCTIONS

First Six-Month Totals Indicate Record Year for 1946

JOHN D. WILSON, *McGraw-Hill Economics Staff*

AN EXCEPTIONAL NUMBER of electric light and power companies are reducing rates this year. During the first six months, ELECTRICAL WORLD carried announcements from 80 companies of lower charges to various categories of consumers. This contrasts with 49 announcements carried over the same period in 1945.

This action on the price of electricity is in startling contrast to the upward movement of most prices. Moreover, the contrast is heightened by the fact that many of the same cost pressures now badgering producers of manufactured goods also beset the electrical utilities. Utility wage costs are steadily rising, with average hourly earnings as reported by the Bureau of Labor Statistics advancing from $1.18 in December to $1.275 in June and to higher levels since then. Raw material costs are also climbing, with coal in the vanguard.

A number of factors have combined to bring about current rate reductions. The most immediate is the rise in net income stemming from the removal of the excess profits tax. During 1945, electrical utilities paid an excess profits tax of $173 million. In the absence of any other factors affecting income, the removal of this tax would increase net income about $120 million. (The industry's 1945 net income totaled $534 million.)

Still another factor has been the decline in the rate of return for money which apparently has led some commissions to consider a lower rate of return.

Two-thirds of the companies that have reported rate changes are reducing their charge to residential consumers; about one-half are lowering commercial rates, while approximately one-third are decreasing industrial power charges. A large number of companies, of course, are changing rates for more than one class of consumers, and almost one-third of the total report they are lowering rates to most of their principal consuming groups.

Of particular significance are the relatively heavy reductions in certain of the small industrial and commercial rate classes, for not many companies have changed these in recent years.

The decline in residential and commercial rates, of course, is tied to the continued expansion of sales of electricity to these markets since V-J Day. Residential usage during the first six months was up about 13 percent from the level of a year earlier, while small light and power sales increased about 4 percent over the same period. The result has been substantially higher gross revenues for many companies from these markets.

Rates Lower in All Sections of Country

Every state has some section that now is realizing the benefits of a recent reduction in electricity rates. However, the decline is more widespread in certain regions than in others. In Illinois, for example, the State Commission has ordered that rates be reduced throughout the state, and a widespread decline also has taken place in Indiana and other north-central states. In the West, fairly general rate reductions have occurred in New Mexico, Arizona, southern California, and the Pacific Northwest.

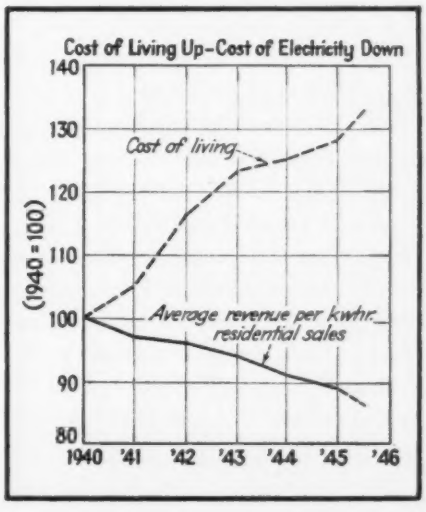
Information as to the total number of consumers affected by recent rate changes has not been compiled, although 21 companies inaugurating lower schedules have reported that more than 3¼ million of their consumers will benefit.

Utility companies are themselves taking the lead in the movement to reduce rates. Only in a smaller number of cases have regulating bodies laid down an order for rates to be reduced and apparently taken the initiative.

Most Reductions Exceed 10 Percent

A number of companies have summarized in percentage terms the net reduction embodied in their new rate schedules. Among such companies, about a third indicated their rates will be 10 to 15 percent lower than previously, while another third are cutting rates more than 15 percent. Only in a few instances, however, is the decline less than 5 percent or more than 25 percent. In general, rate reductions to industrial and commercial consumers are somewhat greater percentagewise than those to residential consumers.

Statistics are not available as to the total saving that is expected to accrue to consumers as a result of current rate reductions. However, some 65 companies report that their customers will realize a saving of $35.3 million annually. There appears to be little doubt that the savings to all consumers for the year as a whole will be the largest ever recorded.



EDITORIALS

S. B. WILLIAMS, *Editor*

REA Lines Proving Inadequate

REA LINES are inadequate to meet the demand. Speaking before the Illinois Association of Electric Cooperatives last week, Administrator Claude R. Wickard said that over half of the REA systems, 432 out of 835, are not able to supply all the power needed by their present customers.

Most of the trouble, the Administrator stated, is that "rural people are using more power than the distribution systems serving them were originally designed to carry." In other words, the lines were designed for the cheapest cost, not for adequate service. It is a serious admission.

As we have indicated in these columns before, the lines built to minimum will have to be strengthened before the farmer can get the quality and quantity of service he has envisioned. At times we have been criticized for these frank opinions as being oppossed to government-financed rural lines. What we were against was construction that later would prove unsatisfactory to the rural customer and the later correction of which would make the overall cost of the lines more expensive than if they had been done right in the beginning.

Not only does the problem lie in more substation capacity and additional feed-in points but also in the service to the individual farm. In order to keep down original cost, REA design for years was on the basis of minimums wherever possible. Particularly has this been true of transformers. If farm usage is to grow, a large part of the transformers on REA lines will have to be replaced with larger sizes.

It may be that here and there a co-op has experienced a power shortage because the supplier was up to the limit, but we believe that these cases generally arose with municipal or very small company sources, many of which we know have been taxed beyond their capacity. The problem, however, is not one of power supply but of lack of foresight in original design, too much emphasis on economy and extension of lines beyond good voltage distances. Now the time has come to pay the price, and we hope, for the sake of the farmers who ultimately must foot the bill, REA will forget its feud with the power companies and work out with them in each instance ways in which the service can be improved most advantageously, not only to provide for today but for the future.

Protecting Live-Line Crews

USE OF LIVE-LINE tools is quite general and the experience warrants consideration of the practice on other systems because it does obviate maintenance outages and spare circuits. Accidents are possible, however, just as may happen when the worked-on lines are presumably de-energized but are often in close proximity to live circuits. Suppose such a mishap occurs during live-line maintenance operations; how are the system operators to know what to do if they see the disturbance manifest itself on their boards?

Practice in this respect is evidently quite diversified. In some instances the dispatchers are formally made aware of the live-line crews' operations. If there should be a disturbance they would be in better position to decide whether to follow routine practice in re-energizing after a lapse or to do something special to safeguard the men out on the line. Mobile or other communication facilities must be a great help under such circumstances because word can be gotten from and to the crew supervisors. Probably the wisest thing to do if something goes wrong on a line where a live-line crew is at work is to leave the circuit out until clearance is obtained from the field.

Other procedures to avert an unnecessarily prolonged interruption are to reclose after a few minutes delay on the assumption that the fault was transitory and everyone has had opportunity to get clear. But that is definitely a case of "taking a chance" and deserves careful consideration in framing rules for both the dispatchers and the crew supervisors. The automatic recloser is even more of a problem because it recognizes no human differentials. To be doubly sure, such devices can be locked out during the period of live-line work.

Fortunately, there are few instances where these issues arise, but that is no reason for ignoring the peculiar deviations from conventional functioning that can conceivably occur when men are disturbing the normal disposition of conductors while striving to improve conditions without killing the circuit.

Objectives in Cable Shielding

EVERY SO OFTEN a term gets into reasonably common use before engineers in general acquire a fair understanding of what precipitated the issue and why practice evolves as it does. The initiated who have had intensive troubles with cable dielectrics, particularly the kinds that are affected adversely by corona, have good reason to know why shielding can be a remedy. But even they accept the term itself glibly, seldom stopping to consider whether or not the phenomenon is akin to the shielding of transmission lines with overhead ground wires or of the leads in refined laboratory measurement set-ups where leakages or spurious capacitances may vitiate the results.

Shielding in cables might as well, or even better, be called flux control, because that appears to be its objective, particularly "shielding" applied at the surface of the ener-

gized conductor. The point is to redistribute the tufts of flux at the sharply curved strands and thus reduce the disposition toward corona at the points of concentration. Anything that is sufficiently conductive so as to reframe the flux pattern toward what it would be with a smooth conductor of equivalent electrical diameter proves helpful in averting the concentrations. Conductive tapes, rubbers and foils and admixtures of semi-conductive ingredients are some of the prevailing procedures in conjunction with main body dielectrics that fall prey to corona.

So-called shielding by or on the outer covering is in one sense a different matter and in another sense the same matter. One factor that is common is the desirability of controlling or diffusing electric stresses at points of contact or proximity to grounded circuits or hardware. A separate factor in the case of outside shielding is the one of possible increased hazard to men who might otherwise be working on external covering that would be insulating in character.

If these brief comments on shielding arouse any doubts or dissents, they merely prove that the practice and its purposes need further exposition even if some of it has to start with as rudimentary a sketch as the professor was wont to draw with his chalk when he arrived at corona.

New Output Records Again

AFTER a lapse of a year, the weekly electric energy output figures are once more establishing new seasonal highs. For four weeks the current figures have shown gains over 1945 and, what is more significant, have been ahead of 1944 for the last two recorded weeks.

Starting from the year's low in the Memorial Day week the output has climbed at what is probably the fastest rate on record. Nothing even in the fast growing war years of 1942 and 1943 equalled it for steepness of rise. By August, however, the speed of recovery had begun to lose some of its momentum and as the month closed there was a tendency to flatten out. Such a situation, however, is not unusual at this time of the year.

Should the present trend be maintained in the fourth quarter, a new all-time peak week in December appears likely, and since load factors are below those of the war years, a new high of kilowatt peak is indicated.

Controlling Interconnection Losses

WHEN THERE ARE several parallel transmission paths for the energy to follow, the currents will naturally divide among them in inverse proportion to the respective impedances. That is a fundamental principle and it can only be circumvented by injecting artificial factors. An issue can, however, arise when the resulting flows violate an interchange contract or overload a particular circuit, or the respective power factors are definitely disadvantageous. But should not the question also be raised when analysis is made of losses and their possible over-all reduction, particularly the incremental losses?

It is logical to become disturbed about losses because they are a burden on the earning capacity of the revenue energy. It is equally logical, since interconnections have become more and more complex, to be concerned about the possibility of reducing the cost of delivered energy by observing the routes it has available and then originating that energy at a point whence transmission losses will be the least. Only in this way will the true value of low-cost energy be derived. Meshes comprising several loops can present real complication in determining what the respective losses are for different origins and multiple routes but the calculating boards can be very helpful at this point. They should be particularly useful in getting at incremental losses for incremental energy transfers.

On this matter of incremental losses there can be overlooked the fact that 10 percent more energy results in 21 percent more copper loss on top of what was previously incurred. Either the incremental load has to be charged with this high attendant loss or the economic balance for the previous loads has to be disturbed when the newly incurred loss is parceled among them. That in itself is one sound reason for studying the paths and the generating costs at the sources to make sure that the delivered cost is as advantageously low as can be.

In this way the laissez faire policy of letting things go where they will might yield somewhat to a directed economy of interconnection administration. Otherwise full advantage will not be taken of the considerable study that has been given to preferred loadings for generating stations and units so that division of load will be such as to bring over-all production costs to a minimum. It would be comforting if the reactive component did not have to intrude further to complicate the problem, but fortunately capacitors and condensers are available to relieve the congestion and virtually separate the two worries.

Do You Bind the Year's Issues?

STARTING with the September issues, ELECTRICAL WORLD like most other McGraw-Hill magazines will adopt a standard 8¼- by 11¼-in. page size. We regret that the paper shortage makes this change necessary in the course of the year. We would have preferred, for your convenience, if you bind the year's issues, that the change be made in January. However, we are sure your binder will be as willing and able to meet the situation as ours is. The issues September through December can be filled in at the stitching edge so as to equal the remainder of the year in width. Top and bottom margins of the first eight months are sufficiently wide to allow for trimming to the new length.

We anticipate that this temporary inconvenience will be more than equalized by the advantage of a standardized size henceforth.

WASHINGTON COMMENT

By R. N. LARKIN Washington Correspondent

Government Seeking Lower Electric Bills

COMMENT on the lack of and necessity for simplified, "business-like" handling of the federal government's activities has been so widespread for many years as not to be news. Logically, then, the adoption of such methods bursts into the "man-bites-dog" class and becomes news.

Such, at any event, is the aim of the public utilities division of the Treasury Department's Procurement Division, which is charged with making what savings it can in the government's purchase of electricity.

Not Political

David A. Kosh, chief of the division, prefaces any remarks on his activity with assurance that the work is not aimed at any federal acquisition of utility plant, nor at federal development of competing systems.

"We don't even want any rate cases," Kosh insists. "We are simply power consultants to those federal departments which require electric service. We represent the government as a consumer, not as a governing body with powers of regulation, and distinctly not as a group which merits any special treatment merely because it is the government. Our job is to get the best price which can be had for electric service, consistent with a fair and reasonable return to the company and with fair rates to the other rate payers. We recognize that there is no single fair rate for such service wherever the government buys service."

Kosh's program has implications for every company serving a major metropolitan area in which there is any appreciable federal establishment. The practice is to request data from government agencies and the companies serving them from which is derived either a plan which will enable a reduction in rates or a decision that rates are at their proper level, with no further action needed.

Thus far, Kosh says, the division has written to companies serving about 75 large cities asking for data. The companies concerned have been most helpful, making almost a 100 percent response. In "many" of these cases, he adds, the decision after review of the data was that no action should be taken.

One of the division's most-used devices is to offer the company a single payment for the sum of the individual bills, that is, a consolidation of the bills. This is not an aggregate of meter readings on an existing rate, but may be a combination of readings to be priced on a rate especially designed to reflect the load characteristics and the method of billing. Since, in many of the larger cities, a company may be rendering as many as 500 monthly bills for service to federal agencies, such a consolidation of bills has obvious advantages. Such a proposition generally includes the offer of prompt payment, in one check, of the consolidated bill. Combined meter reading on a specially designed rate was adopted and works nicely in New York City, where the federal establishment is large enough to run up a $100,000 monthly power and light bill. One bill is rendered, bearing a 0.75 percent discount if paid within 30 days of meter reading.

Program of Negotiation

"In many cases," Kosh says, "federal agencies are not on the proper rate schedule. We recognize that, generally, companies do not assume the responsibility for seeing that customers get service under the proper rate. If an agency is not being billed on the most advantageous rate, that situation is called to the attention of the utility with a request for adjustment. Sometimes, we can suggest an entirely new rate schedule which takes proper cognizance of the load characteristics. Several schedules so suggested have been adopted."

When it has been decided that it can do better on rates in a given city, the division prepares its case as if it were going to a commission for a rate case. Then it makes every effort not to go before any commission, but rather to reach an agreement with the company involved.

"I'm not joking when I say that, either," Kosh insists. "Thus far, we've had only one rate case arising from all our work. That was right here in Washington, where the circumstances are different from almost anywhere else in the country, even to the nature of regulation." (Washington has the sliding scale plan, whereunder rates are examined yearly, regardless of complaint.)

Where it seems wise, the division may attempt to write a master contract for the federal agencies requiring service in a single city. Such a contract would not necessarily mean that Treasury Procurement would pay the bill, but it would provide a legal document under which service could be started and stopped with a minimum of difficulty and which would provide standard rates for the same types of service. In describing such a proposal to one company, Kosh wrote:

Single Schedule Advantages

"A single continuing contract would obviously result in advantages both to your company and to the government if the continuing contract were predicated on a single rate schedule. It would reduce the time and cost to the government in auditing bills submitted and would effect economies and tend toward efficient handling of government bills by your company. It would also segregate federal bills in such a manner that any and all tax exemptions based upon governmental use could easily and readily be ascertained from a company tax and accounting standpoint."

In this case, the company renders 54 separate bills monthly for service to federal agencies and sells power to it under nine different rates or service classifications.

NEWS OF THE WEEK

Pittsburgh Gets Injunction, Halts Duquesne Light Strike

City Takes Stand That Utility Is Not Private Enterprise and That Employees Are 'Quasi-Public Servants'—Move May Set Pattern for Preventing Utility Strikes

OWNERS, managers, and employees of public service enterprises throughout the nation riveted their attention on Pittsburgh this week as the city's administrative officers took to the courts their unprecedented contention that a threatened electric power strike must be enjoined on the grounds that:

1. The Duquesne Light Co. is not a private enterprise.

2. Its employees are "quasi-public servants."

Regardless of whether the strike restraining order which was granted the city early this week is continued as a temporary or permanent injunction—and Pittsburgh raged this week with arguments as to the legality of the move—the legal bombshell was totally effective in its first duty, that of averting the city's second power strike in seven months.

Actually Pittsburgh had a power strike of perhaps four hours duration. Its effect was limited to suspension of street railway service for less than two hours and the temporary closing of two vehicular tunnels. Each move was precautionary, and in no way due to the company's inability to serve the loads. A few employees lost some time through walking off the job at midnight Monday or failing to report.

A restraining order which bound both company and union, as completely as legal talent could imagine, was issued at midnight Monday, a minute before the strike deadline, by Common Pleas Judge Walter P. Smart. From that point forward, at least until a hearing was held later in the week, Pittsburgh's power strike was over. It took perhaps half an hour to restore street railway service.

The sudden, last-minute termination of a strike threat which had been constantly hammered into public consciousness for more than two months was anti-climactic beside the sweeping implications of the city's action.

What the city did was to ask and obtain a temporary abridgement of the right of Duquesne Light employees to strike. Its assult upon this holiest of organized labor's holy grails was possible and successful primarily for two reasons.

1. The city administration has a pro-labor record which would be difficult to duplicate.

2. It asserted and produced competent witnesses to demonstrate that the impending stoppage in energy supply would first stagnate and then destroy the city and the 1,500,000 residents of Duquesne's service area.

Dr. I. Hope Alexander, City Health Director, swore to the complaint, and was accompanied by the president and secretary of the County Medical Society, the Regional Hospital Council, and the city directors of Public Works and Public Safety as corroborating witnesses.

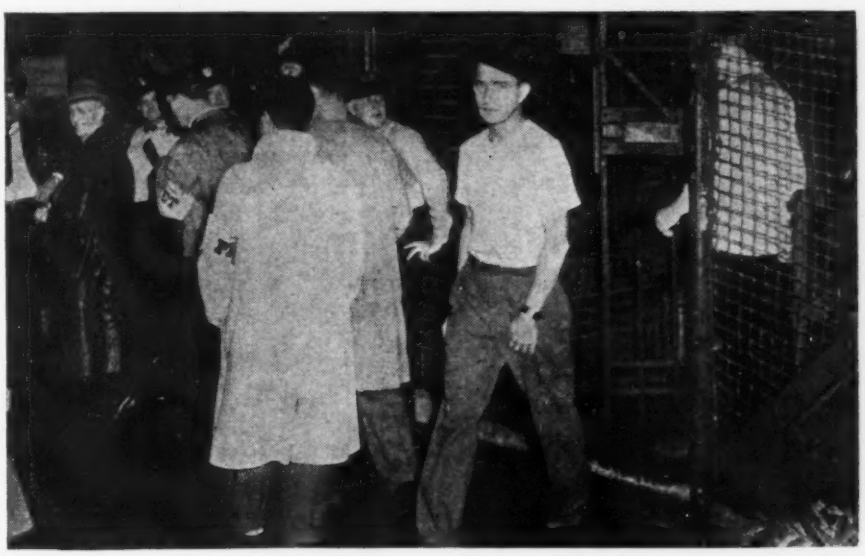
Coming as it did at midnight with little warning, with such substantiation and following a near-hysterical build-up in city newspapers for at least a month, the move was totally successful in the court of public opinion as well as in the Court of Common Pleas.

Numerous other factors which could have contributed to the result were readily to be heard in the discussions which engrossed Pittsburgh this week. Whatever their effect may have been, they were unnecessary.

In preparing the complaint, City Solicitor Anne X. Alpern spurned an existing approach which would have left her on demonstrably firm legal ground despite the existence of Pennsylvania's stringent anti-injunction law.

Instead, she chose to base her case upon what was generally conceded to be a completely new legal approach to the problem of the rights and duties of public service corporations and their employees. As such, the move gave more than scant promise of being the most enduring of the strategems which public officials have yet devised to thwart interruption of utility services.

The city's complaint was reminiscent of the late President Coolidge's assertion that no right to strike against public safety exists anywhere, any time.



PICKETS AT WORK—The pickets, identified by armbands, gather at the gate of a plant of the Duquesne Light Co. shortly after midnight, Monday, when a brief strike was held until halted by a court order

It held in part:

"The members of the Independent Association who elected to work for this utility and its associated companies are quasi-public servants. The acceptance of public utility employment carries with it an obligation to maintain the functions of the utility in continuous peaceful operation and to resort to orderly processes for adjusting labor disputes."

This was tantamount to—and was promptly so hailed by Pittsburgh newspapers—an affirmation of the public's right to strike against the right of utility employees to strike.

The city's move against Duquesne was less sweeping perhaps but only because of the sanctity hitherto accorded the right to strike. The complaint added that:

"The operation of a public utility carries with it the responsibility of establishing a fair and sound labor relations policy. Public utility companies which fail to render adequate and continuous service to the public by reason of their failure to maintain proper labor relations, are not entitled to enjoy the franchises granted them and can not relieve themselves of responsibility for failure to render service."

A.F.L. and C.I.O. Remain Aloof

One of the most interesting topics, as the first flurry faded into waiting for a hearing on the injunction, was whether or not the American Federation of Labor and the Congress of Industrial Organizations would appear against the injunction. Customarily, such support would be almost automatic. In Pittsburgh, however, the situation was complicated by the fact that Duquesne workers are represented by an independent union which has had numerous jurisdictional conflicts with each, and which has successfully resisted raids on its membership. This fact thrust a strategic consideration into the question, for both constituent unions of major labor groups are presently trying to take over the independent. It was not difficult to find informed opinion that the A.F.L. and C.I.O. will pass this struggle.

In support of this contention, numerous logical reasons could be advanced. Perhaps the most compelling are the staunch pro-labor record of the Democratic party which launched the move, and the unhesitating assertion of city officials that they would not consider applying it even to utility workers who are not concerned directly with the production, transmission and generation of electric energy, or similar direct production and distribution of an equally vital public service. Had the

HIS SIDE OF THE STORY—George L. Mueller, president of the Independent Union of Duquesne Light Co., making the broadcast setting the time of the strike

Duquesne strike threat come from nonproduction workers, the city would not have made its move. Pittsburgh labor leaders know this.

Their ranks include President Philip Murray of the C.I.O., and numerous of the most powerful men in the United Mine Workers, now an A.F.L. affiliate, and top officials of the powerful United Steel Workers, a C.I.O. affiliate.

With labor leaders of this caliber knowing their antagonist, Pittsburgh Mayor David Lawrence, as well as they do, and with the ultimate legality of the move as open to question as it is, there is logical reason to doubt whether the A.F.L. and C.I.O. will make this fight their own, at this stage anyway.

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July Energy Production At Highest Since War's End

Production of electric energy for public use during July, 1946, totaled 18,610,399,000 kw.-hr., according to a report issued by the Federal Power Commission. This is the highest monthly production since August, 1945, which marked the war's end and is only 1.8 percent below July, 1945. Combined production of utilities and industrial establishments of the country was 22,571,889,000 kw.-hr. during July, a decrease of 2.1 percent below July of last year.

Average daily production of electric energy for public use in July was 646,194,000 kw.-hr., an increase of 1.2 percent when compared with the average daily production during the previous month, but a decrease of 1.8 percent below July, 1945.

Production by water power in July amounted to 6,409,548,000 kw.-hr., or 34.4 percent of the total output for public use.

Georgia Power Co. Puts Oilostatic Cable in Service

Georgia Power Co. has put into service the longest oil-filled pipe cable in the world, connecting its Boulevard and Grady substations. President W. E. Mitchell closed the switch to energize the cable with 75,000 kw. in climaxing the ceremony marking completion of the work started last November.

The 5-mile long cable is laid an average of 4½ ft. below the street surface, and has almost double the capacity of a conventional 110-kv. overhead line. At each end, the underground cable ties in with existing overhead transmission lines which run from Boulevard and Grady substations to the Northwest and East Point substations, both of which are directly connected with Plant Atkinson, Atlanta's largest power plant. The new link completes the 110-kv. circuit around the city to strengthen service and provide additional capacity for the downtown area.

The new oilostatic cable is the first of its type in the South and one of the comparatively few in the nation. Similar oil-filled pipe cables are in a few large northern cities, but none of these equals the length of the Atlanta cable. Electrical engineers from all parts of the country have visited the cable project during its construction.

The Okonite oilostatic cable is made up of three 350,000-cm., 37-strand conductors cased in a steel pipe which is coated with a thick asphalt type covering. The line is protected by a concrete shield.

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Sewaren Unit to Operate at 1,050 Deg. F. Inlet Temp.

The construction of a 100,000-kw., 3,600-rpm. unit which will operate with steam at 1,500 psig. and 1,050 deg. F., the highest inlet temperature yet attempted, is now underway, Westinghouse Electric Corp. has announced. The unit is intended for the Sewaren station of the Public Service Electric & Gas Co., Newark, N. J. Although other stations operate with higher initial steam pressure, the 1,500 lb. of the Sewaren unit represents a material advance in pressure over the 1,250 lb. that has otherwise been the top for power station use.

The steam turbine, a tandem compound unit with a double-flow, low-pressure element, is capable of driving a 95,000-kw. main generator and a 7,500-kw. house generator. The main generator is rated at 85 percent power factor, the house generator at 80 percent power factor.

$25,000,000 Estimated Cost of 75,000-Kw. Atomic Plant

Report to United Nations Foresees 8 Mills Per Kw.-Hr. as Operating Cost—Comparable Coal-Fired Steam Plant Would Cost $10,000,000 and Supply Power at 6.5 Mills

FIRST OFFICIAL ESTIMATES of the cost of atomic electric power plants for installation within the near future was laid before the United Nations last week in a report which asserted that a plant of 75,000 kw. capacity "could be built in a normal locality in the Eastern United States for approximately $25,000,000."

Assuming operation at 100 percent load factor and interest at 3 percent, the report foresaw operating costs of 8 mills per kw.-hr. By comparison, the report cited $10,000,000 as the cost of a comparable coal-fired, steam-electric plant, and operating costs, similarly computed, of 6.5 mills. It added, however, that atomic-electric costs might be expected to decline, while coal and oil costs "have increased greatly since before the war and show signs of increasing further in the future."

The report was drawn up by members of the staffs of Clinton Laboratories, at Oak Ridge, Tenn., and of the Monsanto Chemical Co., which operates the laboratory. Prepared under the direction of vice-president Charles A. Thomas, of Monsanto, it was based on several assumptions, among them:

1. The nuclear reactor considered for cost estimates would be a modified version of the Hanford, Wash., pile at which the Manhattan District has been producing plutonium for some time.

2. Operating temperatures would be "high enough to supply power," i.e. substantially above Hanford operating levels.

3. Plutonium produced in the power pile would be recovered for subsequent use in the power plant, an about-face from Hanford procedure in which plutonium is recovered for the manufacture of weapons.

Until atomic-electric development has made some progress, the report asserted, "labor and supervision charges for the nuclear plant are expected to be greater than for the coal plant."

Significance of the cost estimates contained in the report was difficult to grasp fully and immediately principally because of the scantiness of the information.

On the basis of the figures given, comparative costs per kw. at current price levels was $334 for the atomic-electric plant, and $133 for the coal-fired thermal plant. The report added that "equality of operating costs between coal power plants and nuclear plants would be reached if coal cost $10 per ton."

Excerpts from Report on Atomic Power Plant

A number of types of nuclear power plants have been considered. For the present cost comparisons it was decided to consider a modified Hanford-type pile, since more design and operating information is available for this type than for any other kind.

The commercial pile which is being considered here would differ from the Hanford pile in two important aspects:

(a) The operating temperature would be high enough to supply power.

(b) All the plutonium formed would be recovered for later consumption in the pile. No attempt would be made to produce plutonium for use elsewhere.

While no such plant has ever been built or even designed, it is felt probable that a large stationary nuclear power plant could be built. Based on prices now current, a plant designed along the lines indicated and producing 75,000 kw. could be built in a normal locality in the eastern United States for approximately $25,000,000. On the assumption that the plant would operate at 100 percent of capacity and that interest charges on the investment would be 3 percent, the operating cost of the plant would be approximately 0.8 cents per kw.-hr.

This is to be compared with a coal power plant which would cost $10,000,000 under the same conditions. The operating cost depends on the price of coal. The price of bituminous coal of 13,500 Btu. is about $3.50 per ton at the mine and about $7 per ton delivered to the furnace of a power plant in eastern United States. The operating cost of such a power plant would be approximately 0.65 cents per kw.-hr., again on the assumption that the plant would operate at 100 percent of capacity and that the interest charges on the investment would be 3 percent. Equality of operating costs between coal power plants and nuclear power plants would be reached if the coal cost $10 per ton. It must be realized that lower costs of nuclear power plants can best be achieved by continued research and development.

Comments

It is not altogether a case of nuclear power versus coal, gas, oil, or water power, because the nuclear power plant has advantages and fields of application not open to other types of power producing plants.

Nuclear power plants in contradistinction to hydroelectric power plants have the advantage of being able to supply process and heating steam directly in addition to power. Because nuclear plants lend themselves to decentralization, more economical industrial combinations should develop.

The nuclear power plant might aid in the industrial development of isolated parts of the world where the cost of oil, gas, or coal is prohibitive and where a suitable supply of water is unavailable, because the nuclear power plant, if combined with the modern gas turbine, would make unnecessary a supply of any such fuels or cooling water.

The nuclear power plant, in connection with the modern gas turbine, might be desirable as operating or stand-by plants to existing large utilities.

It is the belief of many of the scientists and engineers connected with this work that a comparatively small standardized nuclear power plant will be developed. If this reasonable prediction comes to pass, such power plants can be placed at strategic points on all established utility company systems. They would greatly reduce power transmission costs and insure partial operation of the system even if the standard super-power station of the system were inoperative. Such a development would of course complicate any inspection system.

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60,000-Kw. Steam Plant Will Be Erected by Vepco

Virginia Electric & Power Co. will start work immediately on the construction of a 60,000-kw. steam power plant near Dumfries, Va., located on the Potomac River at its junction with Quantico Creek. Cost of the plant, which is to be completed within two years, will be $7,500,000. The plant will be almost a duplicate of the Chesterfield plant, which is about 15 miles south of Richmond on the James River and which was completed during the war. The new plant will be equipped to burn either coal or oil.

The company has acquired a 1,000-acre site with about two miles of water front on the river channel. The location is about half way between Fredericksburg and Alexandria, and the new plant will be connected by transmission lines with the main line running from Richmond to Alexandria, and also with the main line running from Charlottesville to Alexandria.

A new 110-kv. line is to be built from the main substation at Occoquan to a point near Falls Church.

Need for Floating Plants Brings WAA 11 Bidders

Foreign Governments, State Power Authority, and Private Utilities Eager to Buy 30,000-Kw. "Resistance" as Loads Continue to Grow and Strikes Hold Up New Installations

THE SURPRISING SPEED with which electric power systems have recovered losses in war loads and the strike-born delays in installations of new central station capacity has brought 11 bidders to the War Assets Administration for the third 30,000-kw. floating power plant to be offered for sale by the Federal Government.

Four of the bidders were foreign countries one of which—Belgium—had an opportunity to buy the "Resistance" some months ago before it was returned to this country from Antwerp.

Bidders and their bids were reported as follows:

China, $2,415,000; Eire, $600,000; Belgium, $1,142,250, delivered at Antwerp; Greece, $2,875,000; South Carolina Public Service Authority, $1,500,000; Georgia Power Co., $1,100,000; Pacific Gas & Electric Co., $1,311,000; Union Electric Co. of Missouri, $2,575,000; Southern California Edison Co., an 18-month lease at $10,000 or $25,000 monthly depending on delivery conditions; Louisiana Power & Light Co., $2,500,000 with the company to assume the first $100,000 worth of repairs necessary to put the unit in first-class operating condition.

Public Service Co. of New Hampshire, four bids, the first for $3,013,000, of which $874,000 would apply to the company's claim of more than $4,000,000 against the War Shipping Administration for the floater "Jacona," which was commandeered some time ago. Other bids were $2,575,000 in cash; $2,575,000 in cash plus an offer to settle the "Jacona," claim for $3,100,000; and the "Resistance" for nothing and a cash payment to the company of $525,000 in full settlement of the Jacona claim.

Under the Surplus Property Act, WAA is not bound to consider only the amount of money bid. It must consider a number of more or less intangible factors, including the bid in relation to fair value, proposed utilization of the property, effect of the sale on full employment, and numerous other considerations.

On this basis, there seemed to be little chance that it would be sold outside the United States. South Carolina Public Service Authority, as a State agency, could have had the unit without contest within 30 days after it was offered for sale by exercising its preference under the Surplus Property Act. It failed to do so, however, reportedly because such sales must be made on the basis of fair value rather than competitive bidding.

The "Resistance" is the third of four sister floaters to come up for sale. The "Seapower" was sold some months ago to the Puerto Rico Water Resources Authority for $2,500,000. The "Inductance" was sold recently to Jacksonville, Fla., for a similar figure. The "Impedance" is still in service at Manila.

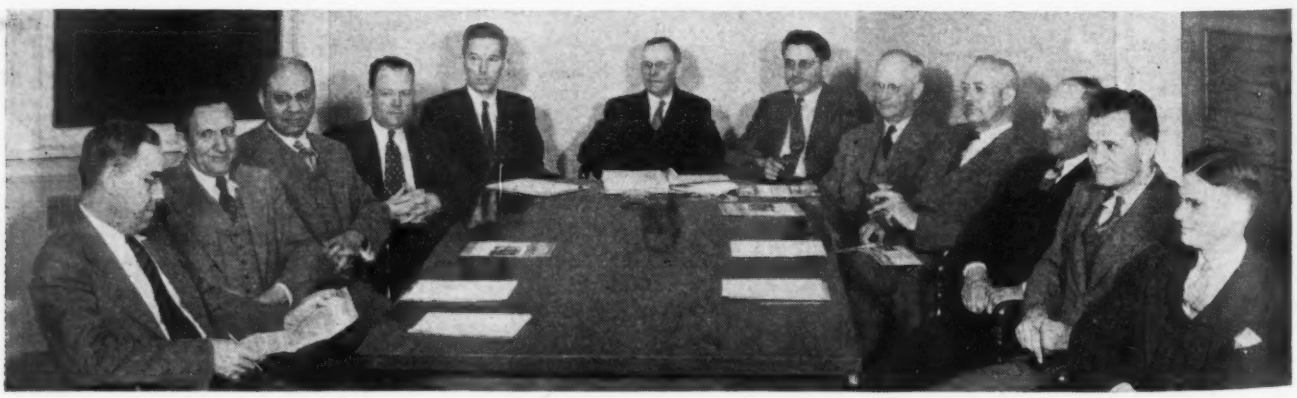
In addition to the fact that many systems need additional generating capacity and that such capacity installations have been thrust about one year behind schedule because of numerous strikes, both in electrical manufacturing plants and in the workings of materials suppliers, two other reasons are seen why private companies are anxious to obtain the "Resistance."

For one thing, the money invested in it will start earning immediately rather than after a two-year installation period. Additionally, its cost per kw., even at the highest utility bid, compares most favorably with the cost of a central station steam plant today. At $2,500,000, the floaters cost per kilowatt would be $83. Present costs are reported to range from $140 to $190 per kw. for steam-electric plants.

Early this week, but before any WAA announcement as to the successful bidder, speculation was the "Resistance" would go either to Public Service of New Hampshire or to Louisiana Power & Light. The latter based its bid entirely upon necessity for additional capacity.

Louisiana reported that a 35,000-kw. plant in New Orleans is one year behind schedule in installation. In addition, a 35,000-kw. machine at its Sterlington plant is out of service indefinitely for repairs, while a second 35,000-kw. unit there must operate at 10,000 kw. less than capacity because of blade trouble. Elsewhere on the interconnected system of which Louisiana is a part, another 35,000-kw. unit is one year behind schedule in installation, and a second is not due to be in operation until 1948.

Louisiana asserted, further, that the floater will fit into its system in at least 12 places. Of these six are major river crossings, any one of which would take 18 months to replace. Availability of the floater to tie into any that might be damaged would change an indefinite outage into a comparatively brief one.



PREPARING FOR THE OPENING—The Board of Directors of the Engineers' Society of Milwaukee meets to discuss details of the dedication on September 21, of the Society's new headquarters

Rocky Mountain League Stresses Industry Unity

Grover C. Neff, E.E.I. President, Urges Utilities Get Extra Help to Increase Usage of Electricity on Farm—NECA Official Calls Contractor No. 1 Publicity Man

TEAMWORK and cooperation to solve the industry's many problems formed the theme note of the 43rd annual convention of the Rocky Mountain Electrical League held September 5-7. at Estes Park, Colo.

President Grover C. Neff of Edison Electric Institute asked utilities for greater support of their own several industry organizations and to go along with the program of the coordinating committee that has been set up to correlate the activities of these associations.

In speaking of rural electrification he said that despite the fact that 60 percent of the electrified farms of America are served by private utilities, yet the industry has been accused of not doing a job. Farm load is the most neglected class of business, and he urged assignment of from one to two men per 1,000 customers to aid in developing electrical usage on the farm. He further urged that utilities meet with local managers of REA co-ops and work out a definite program of extending service on an area basis that will result in orderly development from here on in. "We started the job, let's finish it." he said.

Paul M. Augenstein, General Electric Co., told all branches of the industry and particularly the utilities that they better inform themselves quickly and thoroughly on every phase of liquid petroleum bottled gas if they expect to halt the inroads of well organized competition for the farm load.

George B. Roscoe, National Electrical Contractors Association, said that the electrical contractor is the industry's No. 1 public relations man and that the contractor is hard at work to make himself the best salesman in the industry. Through a strong national association the contractor is elevating his position and is now carrying his proportion of the promotional load. His association is strongly opposing the efforts of some REA officials in Washington to destroy free enterprise in the electrical business through REA by furnishing all materials on rural extensions and putting contractors in the position of being merely labor brokers. Contractors cannot survive as labor brokers only, he said.

TWO PRESIDENTS—Luke Storey, left, Rocky Mountain Electrical League, and Grover C. Neff, E.E.I.

APPARATUS AND CONDUCTORS—C. F. Wagner, left, manager, Central Station Engineering, Westinghouse, and M. E. Noyes, Alcoa's conductor division

We are limiting our own market if lighting is uncomfortably bright, said Ward Harrison, General Electric Co., Nela Park, and it is only fair to ask the whole industry to help in banishing glare, for it is the greatest deterrent to better lighting. We have just talked about glare for 40 years, but now we are in a fair way to get a numerical factor for glare which will prove a useful design tool. The other factor in good lighting is enough foot-candles for comfortable seeing. With the proportion of fixtures now being sold running 90 to 95 percent fluorescent, and despite the war boost in intensities, we will have to run fast to stay where we are on a wattage replacement basis, said Harrison. We can no longer judge the effectiveness of a sales force by kw. added—we must hold and consolidate our gains.

James T. Coatsworth, E.E.I., urged member companies to take full advantage of the Institute's many sales training courses now available. He warned that the need for extensive selling will be back again and said that persistent hard plugging by a well trained sales force will still be the way load will be built when the present sellers' market is over.

Some fundamental and practical aspects of atomic power were presented by C. F. Wagner, Westinghouse Electric Corp. He said that atomic power, when available, would not be a panacea for low-cost energy, particularly in view of the fact that fuel represents only 11 percent of the cost of power to the ultimate consumer.

F. F. McCammon, Public Service Co. of Colorado, said that productiveness of labor must be sustained in our peacetime economy or we are headed for economic chaos. He warned management not to delegate labor relations to third and fourth level men if it hopes to maintain satisfactory relations. Only top management with the authority to make decisions and back them up should handle labor problems.

A round table discussion on industry cooperation with W. C. Heston, ELECTRICAL WORLD, as discussion leader brought out from manufacturer, distributor, contractor, dealer, and utility spokesmen the fact that only by helping the contractor and the dealer to strengthen their positions and by the manufacturers and distributors main-

GET TOGETHER—Ward Harrison, left, of General Electric's Nela Park, and President John E. Loiseau, Public Service Co. of Colorado

taining ethical policies of distribution, can the industry achieve greatest success in developing electrical usage and securing for our industry a greater and greater proportion of the public's dollar.

Elected to succeed Luke Storey as president of the League, was J. B. French, president, Black Hills Power & Light Co., Rapid City, S. D.

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Benton County P.U.D. Votes Utility Purchase Approval

Benton County Public Utility District commissioners at Prosser, Wash., have voted approval of the purchase of all Pacific Power & Light Co. holdings in that county.

To finance the purchase, the board adopted a resolution authorizing the sale of $1,550,000 in electrical revenue bonds, Chairman Preston Royer announced.

The purchase agreement was made at the $1,265,000 figure established earlier this year by a Federal Court jury in Yakima, hearing condemnation proceedings against the private company.

The bonds, to run over a period of 30 years, were purchased by Ballard-Hassett Co., Des Moines, Iowa. The contract stipulates they may be retired after five years. Interest was given as 2 percent on $700,000, 2½ percent on $500,000 and 3 percent on $350,000.

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Canadian Island Electrified

A start has been made in the electrification of Campobello Island, N. B., on the United States border. The line will begin at St. Andrews, nearest Canadian mainland point about twelve miles away, and will go by way of Deer and Indian Islands. Cable will be used to carry power under the channels between the islands.

Campobello is the last of three sister islands at the mouth of the Bay of Fundy, all of which are closer to the United States than to Canada, to be electrified. The other islands are Deer and Grand Manan. The New Brunswick Electric Power Commission is the owner of the power system.

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Rural Loans Granted

The Rural Electrification Administration in the period from July 26 to August 5 announced loans totalling $13,737,000 to 45 cooperatives in 20 states. Most of the loans were for the construction of lines, of which 9,476 miles are to be built to serve 25,623 customers.

2 Units of Co-op Damaged; FBI Called to Investigate

Operatives of the Federal Bureau of Investigation are investigating the breakdown of two generators providing electricity for the Cuivre River Electric Cooperative, Inc., Troy, Mo., which is involved in a labor dispute with the local of the International Brotherhood of Electrical Workers, A.F.L. The F.B.I. was called in because the co-op financed its system with REA loans.

One diesel unit, enclosed by a fence on a farm near Troy, broke down on August 17 because vandals had poured an abrasive mixture into the engine lubricating oil. A similar unit, near Wentzville, broke down on August 27 because a field coil burned out; this, Manager W. E. Longnecker said, may have been caused by an operational overload.

The co-op halted construction of additional rural lines early in August because the union insisted maintenance men, who are paid 75 to 96 cents an hour, should limit their construction work to 3-pole extensions of existing lines and that all other construction be handled by employees paid at the contractors' rate of 90 cents to $1.75 an hour. The co-op then laid off half of its maintenance staff of eight men.

MEETINGS

Pennsylvania Electric Association—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., October 1-2. A. B. Millar, managing director, State St. Bldg., Harrisburg, Pa.

ASME-AIME Joint Fuels Conference—Bellevue-Stratford Hotel, Philadelphia, Pa., October 24-25. A. W. Grosvenor, c/o Drexel Institute of Technology, Philadelphia, Pa.

New Jersey Utilities Association—Annual meeting, Seaview Country Club, Absecon, N. J., November 22-23. Harry Bacharach, executive director, Atlantic City, N. J.

Previously Listed

Instrument Society of America—National Instrumentation Conference and Exhibit, Wm. Penn Hotel, Pittsburgh, Pa., September 16-20. Richard Rimbach, executive secretary, 1117 Wolfendale St., Pittsburgh 12, Pa.

Illuminating Engineering Society—National convention, Chateau Frontenac, Quebec, September 18-21. A. D. Hinckley, executive secretary, 51 Madison Ave., New York 10, N. Y.

International Association of Electrical Inspectors Northwestern Section, Boise Hotel, Boise, Idaho, September 23-25; W. L. Gaffney, secretary, 408 City Hall, Tacoma 2, Wash. Southwestern Section, Hotel Sacramento, Sacramento, Calif., September 30-October 2; H. L. Gerber, secretary, 205 City Hall, San Francisco, Calif. Southern Section, George Vanderbilt Hotel, Asheville, N. C., October 14-16; A. M. Miller, Secretary, 910 W. 30th St., Richmond 24, Va. Western Section, Gibson Hotel, Cincinnati, Ohio, October 21-23; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis 9, Ind. Eastern Section, Mark Twain Hotel, Elmira, N. Y., October 28-30; F. N. M. Squires, secretary, 85 John St., New York 7, N. Y.

Indiana Electric Association—French Lick Springs Hotel, French Lick, Ind., September 25-27. E. F. Hauser, secretary, 1414 Circle Tower, Indianapolis, Ind.

Municipal Electric Utilities Association of New York State—Annual conference, Mark Twain Hotel, Elmira, N. Y., September 25-27. T. J. McKee, secretary, 200-212 E. Third St., Jamestown, N. Y.

American Society of Mechanical Engineers—Fall meeting, Statler Hotel, Boston, Mass., September 30-October 2. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

International Association of Electrical Leagues—Annual conference, Astor Hotel, New York, N. Y., October 2-4. O. C. Small, secretary, 155 E. 44th St., New York 17, N. Y.

Southeastern Electric Exchange—Engineering and Operation Section, Henry Grady Hotel, Atlanta, Ga., October 3-4; Accounting Section, Fort Sumter Hotel, Charleston, S. C., October 17-18; Commercial Section, Atlanta Biltmore Hotel, Atlanta, Ga., November 6-9. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 1, Ga.

National Electronic Conference—Second annual conference, Edgewater Beach Hotel, Chicago, Ill., October 3-5. E. H. Schulz, secretary, Illinois Institute of Technology, 3300 S. Federal St., Chicago 16, Ill.

Edison Electric Institute — Electrical equipment committee, New Ocean House, Swampscott, Mass., October 4-5; transmission and distribution committee, Cavalier Hotel, Virginia Beach Va., October 7-8. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

American Institute of Electrical Engineers—Great Lakes District, Claypool Hotel, Indianapolis, Ind., October 9-11. H. H. Henline, secretary, 33 W. 39th St., New York 18, N. Y.

National Electrical Confractors Association—Annual meeting, Ritz Carlton Hotel, Atlantic City N. J., October 14-18. C. J. Harder, national secretary, 633 Investment Bldg., Washington 5, D. C.

Electrochemical Society—Fall meeting, Royal York Hotel, Toronto, Canada, October 16-19. Colin G. Fink, secretary. Columbia University, 3000 Broadway, New York 27, N. Y.

Pennsylvania Electric Association—Electrical equipment committee, Lord Baltimore Hotel, Baltimore, Md., October 24-25; B. E. Hagy, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia 5, Pa. Transmission and distribution committee, Abraham Lincoln Hotel, Reading, Pa., October 24-25; C. C. Farrell, vice-chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia 5, Pa. Meter committee, Benjamin Franklin Hotel, Philadelphia, Pa., November 7-8; R. A. Black, chairman, West Penn Power Co., Connellsville, Pa. Systems operation committee, Skytop Lodge, Pa., November 7-8; A. R. Deck, chairman, Metropolitan Edison Co., Reading, Pa.

American Welding Society—Annual meeting, New York, N. Y., October 24, and Atlantic City, N. J., November 17-22. M. M. Kelly, secretary, 33 W. 39th St., New York 18, N. Y.

RLM Standards Institute—Annual meeting, Brighton Hotel, Atlantic City, N. J., October 28.

National Electrical Manufacturers Association—Annual meeting, Traymore Hotel, Atlantic City, N. J., October 28-November 1. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

National Farm Electrification Conference—Sherman Hotel, Chicago, Ill., November 7-8. G. W. Kable, chairman, *Electricity on the Farm*, 24 W. 40th St., New York 18, N. Y.

National Research Council—Conference on Electrical Insulation, Johns-Hopkins University, Baltimore, Md., November 7-9. W. F. Davidson, chairman, Consolidated Edison Co. of New York, Inc., 4 Irving Place, New York, N. Y.

National Association of Railroad and Utilities Commissioners—Annual meeting, New Orleans, La., November 12-15. Ben Smart, secretary, 7411 New Post Office Bldg., Washington, D. C.

Jacksonville, Fla., Buying 30,000-Kw. Floating Plant

Jacksonville, Fla., has signed a lease-purchase agreement with the War Assets Administration allowing the city to buy the floating power plant, "Inductance," for $2,500,000.

The city has already made the first payment of $500,000 from the depreciation reserve account of its municipal system. The remaining $2,000,000 is to be paid in ten equal installments, with the total due at the end of eleven years. Interest payments of 4 percent will raise the payment for the second year to $280,000; interest will decrease $8,000 each year.

The "Inductance," which has a 30,000-kw. capacity, was in operation at Jacksonville for 15 months before the agreement was signed. During this period the city paid a monthly rent of $31,000 in addition to maintenance. This rental now ceases. An attempt by the city to include this $465,000 as a part of the purchase price was rejected by the WAA. City officials say that even with the high rental, the "floater" showed a profit.

Fifty-two men who operated the craft have been transferred to city payrolls, and the "Inductance" will remain tied in to the city system until badly needed land facilities can be erected.

The "Inductance" is the second of the four "floaters" built by the Army and the Defense Plant Corporation during the war to be sold. One was sold some months ago to the Puerto Rico Water Resources Authority. A third has been laid up at the Philadelphia Navy Yard, and a fourth is in the Pacific.

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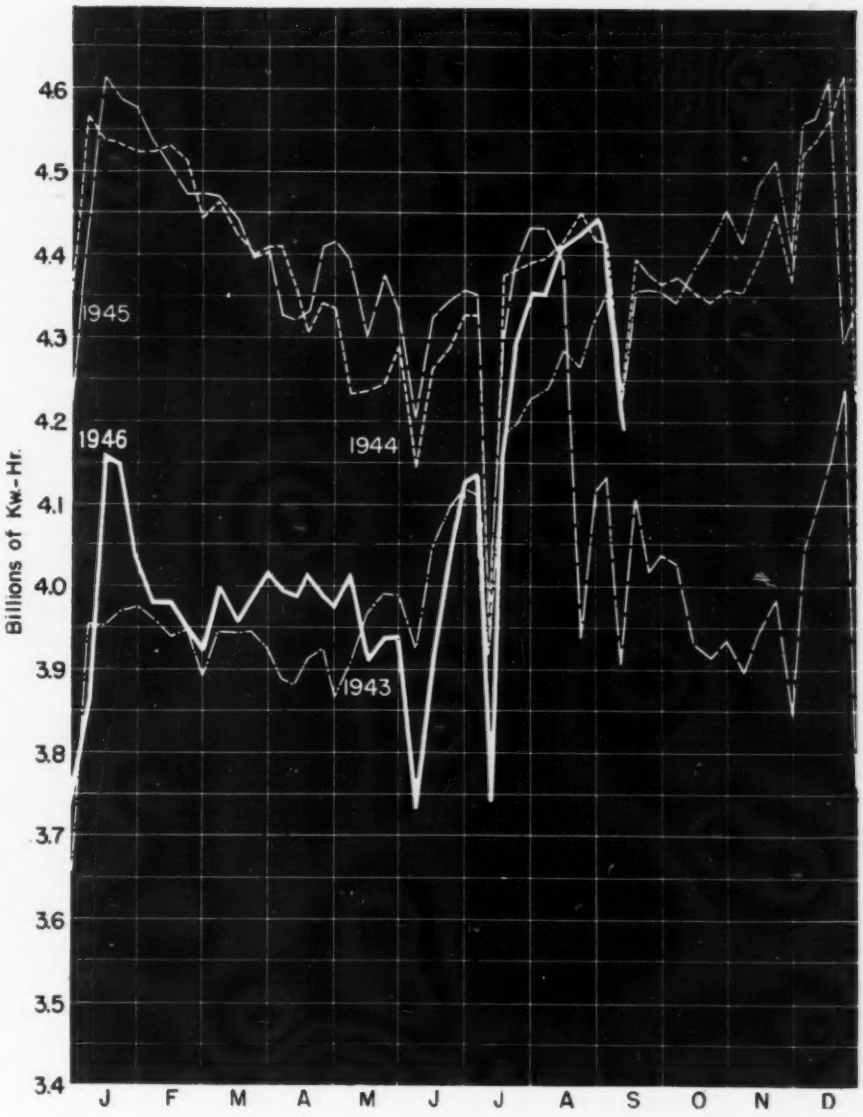
Central Valley Earnings for Year Total $4,089,762

Total earnings on California's Central Valley project for the fiscal year ended June 30 were $4,089,762. Richard L. Boke, regional director of the Bureau of Reclamation, has revealed. Of this amount $3,677,784 was from power sales and $75,000 from rent of the Shasta-Oroville power line; the remainder came from lease of grazing lands, water sales, and miscellaneous sources.

Almost all the power distributed was sold wholesale, under a temporary wartime contract, to the Pacific Gas & Electric Co. at Shasta substation near Redding and at Oroville. Minor amounts of power were sold elsewhere and used by the project itself. Earnings of the project in the five years since its first feature, the Contra Costa canal, went into operation have been $6,285,000.



Electric Output Drops in Labor Day Week

Following the usual seasonal trend, the electric output curve moved sharply downward during the week ended September 7, 1946, which contained the Labor Day holiday. The amount of electrical energy distributed by the light and power industry during the week, according to figures released by the Edison Electric Institute, totaled 4,184,404,000 kw.-hr., compared with 4,404,192,000 kw.-hr. during the preceding week. The amount of electrical energy distributed during the corresponding week of 1945, that of September 8, amounted to 3,909,408,000 kw.-hr., this year's figures representing an increase of 7.0 percent. For the week ended August 31, the increase was only 6.5 percent over the corresponding week last year.

The largest individual gain was again shown by the New England States, 10.0 percent. The only section that reported a lower percent change as compared with the preceding week was the West Central group.

Weekly Output, Millions Kw.-Hr.

1946		1945		1944	
Sept. 7	4,184	Sept. 8	3,909	Sept. 9	4,228
Aug. 31	4,404	Sept. 1	4,137	Sept. 2	4,415
Aug. 24	4,444	Aug. 25	4,116	Aug. 26	4,418
Aug. 17	4,422	Aug. 18	3,939	Aug. 19	4,451
Aug. 10	4,412	Aug. 11	4,395	Aug. 12	4,415
Aug. 3	4,351	Aug. 4	4,432	Aug. 5	4,399
July 27	4,352	July 28	4,435	July 29	4,391
July 20	4,293	July 21	4,385	July 22	4,381
July 13	4,156	July 14	4,295	July 15	4,377
July 6	3,741	July 7	3,978	July 8	3,941
June 28	4,133	June 30	4,353	July 1	4,327
June 22	4,129	June 23	4,358	June 24	4,325
June 15	4,030	June 16	4,348	June 17	4,287

Percent Change from Previous Year

	Sept. 7	Aug. 31	Aug. 24
New England	+10.0	+ 9.4	+11.2
Mid-Atlantic	+ 6.3	+ 5.8	+ 7.2
Central Industrial	+ 9.2	+ 8.6	+10.4
West Central	+ 7.1	+ 7.3	+11.9
Southern States	+ 7.1	+ 7.0	+ 6.6
Rocky Mountain	+ 0.6	+ 0.4	+ 6.8
Pacific Coast	+ 4.6	+ 3.5	+ 4.4
Total United States	+ 7.0	+ 6.5	+ 8.0

SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

STANDARD GAS & ELECTRIC Co. has been authorized to sell 140,614 shares of no par value common stocks of the Mountain States Power Co. The sale will be through competitive bidding. (Release No. 6856).

COLUMBIA GAS & ELECTRIC Co. has received the green light from the SEC on selling to its own stockholders 2,038,312 1/3 shares of the 2,040,000 outstanding common shares of the Cincinnati Gas & Electric Co. The last barrier to consummation of Columbia Gas' proposal was removed when the commission approved a price of $26 a share for the Cincinnati Gas common as well as the compensation to be paid to the group of 228 underwriters headed by Blyth & Co., Inc., and the First Boston Corp. The SEC retained jurisdiction over legal fees and other expenses. (Release No. 6857).

CLEVELAND ELECTRIC ILLUMINATING Co. has been authorized to acquire certain utility and non-utility assets of Cleveland Light & Power Co. for $250,000 in cash. These assets consist of an electric distribution system and non-utility assets consist of a steam distribution system. (Release No. 6859).

CITIES SERVICE POWER & LIGHT Co. and CITIES SERVICE Co.'s joint application in which transactions leading to liquidation of Cities Service Power & Light were outlined has been approved. Cities Service Co. is the parent of Cities Service Power & Light. Under the plan, Cities Service Power & Light will transfer all of its assets to Cities Service Co., which will surrender the 400,000 outstanding shares of Cities Service Power & Light $100 par common stock for cancellation. Cities Service Co. also will make a capital contribution to the subsidiary of $2,700,000, which is expected to be sufficient to enable the subsidiary to pay all of its liabilities, including a $3,000,000 bank loan. Among assets of Cities Service Power & Light to be received by Cities Service Co. are: 2,638,160 shares of $5 par value common stock of Ohio Public Service Co.; 1,366,162 shares of no par value common stock and 90 shares of 7 percent preferred stock, one share of 6 percent preferred stock, and 42 shares of 5 percent preferred stock, each having a par value of $100, of Toledo Edison Co.; 339,639 shares of $15 par value common stock and 1,470 shares of 6 percent no par value preferred stock of Federal Light & Traction Co.; 10,000 shares of no par value common stock of Spokane Gas & Fuel Co.; 100 shares of no par value common stock of the Doniphan County Light & Power Co.; $96,500 principal amount of 6 percent first mortgage bonds of Fremont Gas Co. (Release No. 6865).

COLUMBIA GAS & ELECTRIC CORP.'s application for authority to sell $97,500,000 of debentures at competitive bidding has been approved. SEC reserved jurisdiction over results of bidding. The company will receive approximately $51,200,000 through an offering by underwriters of its entire common stockholding of Cincinnati Gas & Electric Co. to Columbia's Common stockholders, leaving approximately $97,300,000 to be raised from sale of debentures to meet company's cash requirements of $148,500,000. The offering will consist of $77,500,000 debentures, due 1971, and $20,000,000 debentures maturing at rate of $2,000,000 annually from 1947 to 1956, inclusive. Columbia will use $85,000,000 of proceeds from sale of debentures, with cash on hand and proceeds from sale of Cincinnati Gas & Electric Co. common stock to retire $16,500,000 of 1½ percent bank loan notes and redeem preferred and preference stocks, having an aggregate call price of $119,848,075. Remainder of proceeds, estimated at $12,500,000, will be used to assist certain subsidiaries in carrying out construction programs. (Release No. 6866).

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Long Gives Road Advice, Take 'The American Way'

With the basic theme "The American Way—The Right Road," a series of advertisements has been started by Kenneth C. Long, president of the Dayton Power & Light Co. The ads are the projection of Mr. Long's own thinking on various phases of free enterprise.

In order to encourage others to follow his lead in promoting the American way of life, Mr. Long will offer mats of his complete series of twelve messages to one newspaper or business firm in every community, charging only the actual cost of the mats.

Hugo Wagenseil & Associates, Dayton, Ohio, is the advertising agency handling the series.

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New Unit for Tidd Plant

Ohio Power Co. will install a 134,000-hp. unit at its Tidd plant at Brilliant, Ohio, giving it a total capacity of over 250,000 hp. Cost of the unit and additional transmission lines will be $10,600,000.

UTILITY REPORTS

	Net Income 1946	1945
*Alabama Power	$6,016,754	$6,958,243
*American Power & Light and subs	24,295,346	14,180,057
*Arkansas Power & Light	2,698,878	2,551,113
*Birmingham Electric	1,093,071	1,657,517
*Central Arizona Lt. & Pwr.	1,010,844	786,387
*Commonwealth & Southern and subs	24,862,717	16,114,973
*Consumers Power	10,868,500	7,128,851
*Dallas Power & Light	1,813,435	1,464,569
*Georgia Power	6,604,534	4,870,753
*Louisiana Power & Light	1,720,607	1,223,006
*Mississippi Power & Light	1,627,545	1,433,244
*Montana Power	4,913,015	3,991,093
*Ohio Edison	5,406,750	3,542,459
*Puget Sound Power & Light and subs	4,856,223	4,579,512
*Texas Power & Light	3,904,332	2,718,021
*Utah Power & Light and sub	2,141,113	1,838,554
*Washington Water Power	3,574,224	2,379,072

* Twelve months ended July 31.

Rural Service Engineers Take Short Course at V.P.I.

Approximately 50 agricultural and other rural service engineers of electric utilities and cooperatives operating in Virginia were given intensive training on farm electrical equipment at a six-day short course held at Virginia Polytechnic Institute, Blacksburg, September 2-7.

The course was given for the special benefit of men who have been in war service, and to provide special training for new men entering the field of rural service work with electric service organizations.

Sponsored by the Agricultural Engineering Department of V.P.I., in cooperation with the recently organized Virginia Farm Electrification Council, the course covered virtually all types of applications of electricity to the farm.

Special emphasis was placed on new developments in equipment including electric welders, germicidal lamps, lighting equipment, feed-processing equipment, methods of freezing and storing food, and farm wiring.

Classwork consisted of lectures, demonstrations, and laboratory exercises, supplemented by the use of new motion pictures and other visual aids devices. Twenty-four specialists gave instruction on electrical equipment, and represented V.P.I., government agencies, manufacturers, distributers, and electric service organizations.

In charge of arrangements for the school were Chairman E. T. Swink, associate professor of agricultural engineering, V. P. I., and J. L. Calhoun, secretary of the Virginia Electrification Council.

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Union Electric Co. Plans Cut in Water Heating Rates

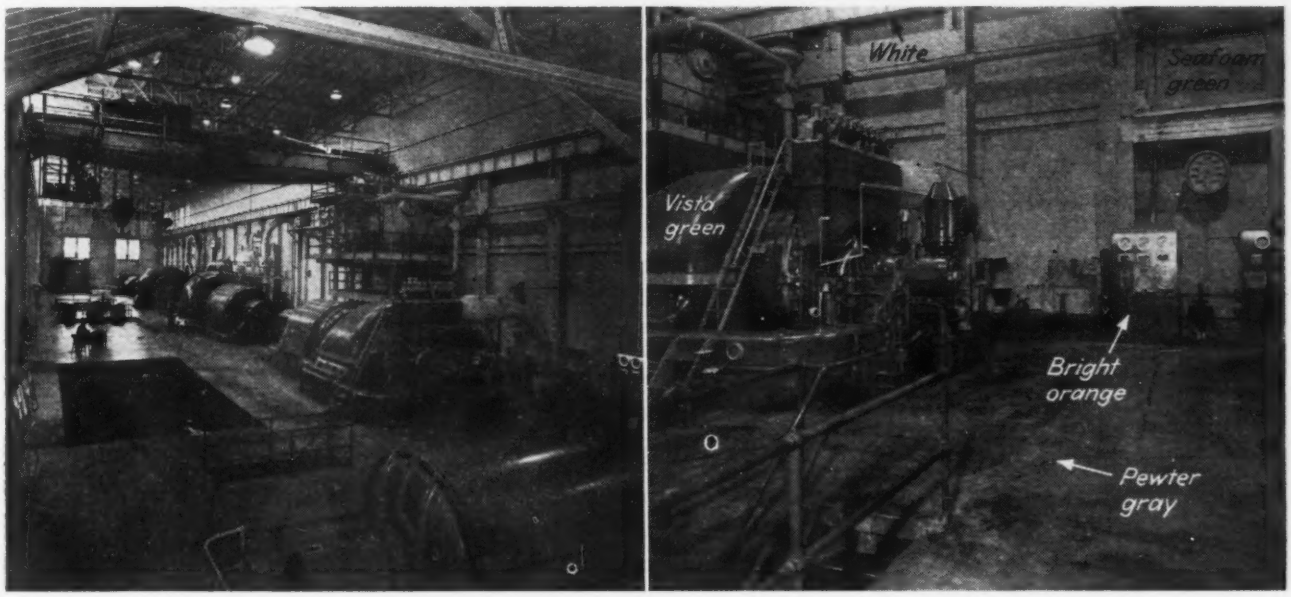
Union Electric Co. of Missouri, which has had no special rate for electricity used in home water heating, has applied to the regulatory bodies of Missouri, Illinois, and Iowa for approval of a rate of 8.5 mills per kw.-hr. for urban and 9.5 mills for rural customers having electric water heaters. The rates, subject to the usual discounts for prompt payment, would apply after October 1.

The company reserves the right to limit such usage of electricity when load conditions warrant it, but customers would be asured of service at least 18 hours a day. The company will also install at its own expense a special meter and time switch for approved automatic storage-type water heaters.

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Light and Color Boost Turbine Room Efficiency



RECONDITIONED TURBINE ROOM—Relighted to 30 foot-candle level using mercury and incandescent sources and repainted in accordance with a new color dynamics scheme, environment in the turbine room of Omaha Steam Station, above, left, is safer, more efficient, comfortable . . . COLOR DYNAMICS—Turbine room employees report operation and maintenance have been made easier through studied coordination of light and color in surroundings. Color of turbine parts, walls, and gage boards is indicated, above, right

E. E. SCHWALM
Industrial Manager
Nebraska Power Co.
Omaha, Neb.

THE COORDINATION of light and color resorted to in the recent redecoration of Omaha Steam Station has produced an operating environment, within the plant, that is not only pleasant but that has contributed materially to efficiency and safety.

Through its sales department the Nebraska Power Co. has long advocated coordinated lighting and painting of industrial interiors as essential to comfort, efficiency and safety. Application of this principle to the company's own properties carries conviction that this doctor at least uses his own remedies.

Both incandescent and high intensity mercury vapor sources were used in relighting the turbine room. Twenty 1,500-watt, No. 691 AL Holophane incandescent fixtures and ten 400-watt, No. 693 AL Holophane mercury vapor fixtures were used. The mercury vapor units, spaced 26 ft. apart, form a row down the center of the turbine room that is flanked on each side with a row of ten incandescent prismatic reflectors arranged on 26- by 31-ft. centers. All fixtures are approximately 46 ft. above the floor. This arrangement provides a fairly even distribution of light with an average intensity of nearly 30 foot-candles.

Painting of the turbine room, in accordance with a new color dynamics scheme, has effected a complete transformation in appearance. The east and west walls were painted a seafoam green to soften light admitted through north and south windows. White was applied to the ceiling, including overhead trusses and superstructure, to hide the clutter and remove the feeling of heaviness overhead. North and south walls were coated with suntone yellow to lighten the dark spaces between the windows and break the monotony of the same color on all four walls. A pewter gray floor gives a pleasing contrast with the walls, machines, portable tools and equipment.

Turbines are painted a vista green with throttle arms and valves in focal yellow. Controls, levers, stairs and railings on the turbines stand out in focal beige. Gage boards are bright orange. Orange block and tackle is used with a focal yellow crane hoist.

Fire fighting equipment stands out in red, of course. Control room, tool room and other important areas in the station have been relighted and painted in a similar fashion.

Turbine room employees like the combination of new lighting and colorful painting. They report that it has made operation and maintenance easier and that the turbine room is far more comfortable and safer. As a result of its redecoration the turbine room has become a show place through which visitors will be taken in the future.

• • •

Plastic Tubing Insulation for Anodizing Tank

W. G. NUTZEL Maintenance Engineer, Otis Elevator Co., Harrison, N. J.

INSULATING the work from the anodizing tank and thereby avoiding short circuits has been rather simply accomplished here by lacing or basket weaving a protective wall of plastic tubing around the inner sides of the anodizing tank.

In anodizing, the tank is usually the cathode and the work hung in the tank is the anode. In many tanks the heating coils (pipes) are of lead and racked around the sides. The work is suspended in the solution and hangs freely. It is therefore almost unavoidable that in a loaded tank the work, upon occasion, will come in contact with either a part of the tank or a lead coil, resulting in a short circuit.

Latticework wood suspended along the sides of the tank did not work well because in a short time the acid attacked the wood and in the process rendered the solution inoperative.

A material to be used as insulation in an anodizing tank must be inert and insoluble in sulphuric or chromic acid baths. It must also withstand temperatures approaching 125 deg. F. The above qualities were found in a plastic tubing known to the trade as Tulox-S and made of Saran.

The method of constructing the insulating barrier was to take some $\frac{3}{4}$-in. tubing for the vertical supports and weave $\frac{3}{8}$-in. tubing through the supports horizontally, on 3-in. square spacings, tieing alternate cross tubing with $\frac{1}{4}$-in. tubing.

A screen, or barrier, was provided for each of the four inner sides of the tank in addition to one for the tank bottom. The screen covers each side from top of tank to bottom and from end to end. Around the inner walls of the tank and also on the bottom are pipes used both for heating and aerating the solution. The screens are secured to these pipes by means of ties with the $\frac{1}{4}$-in. tubing.

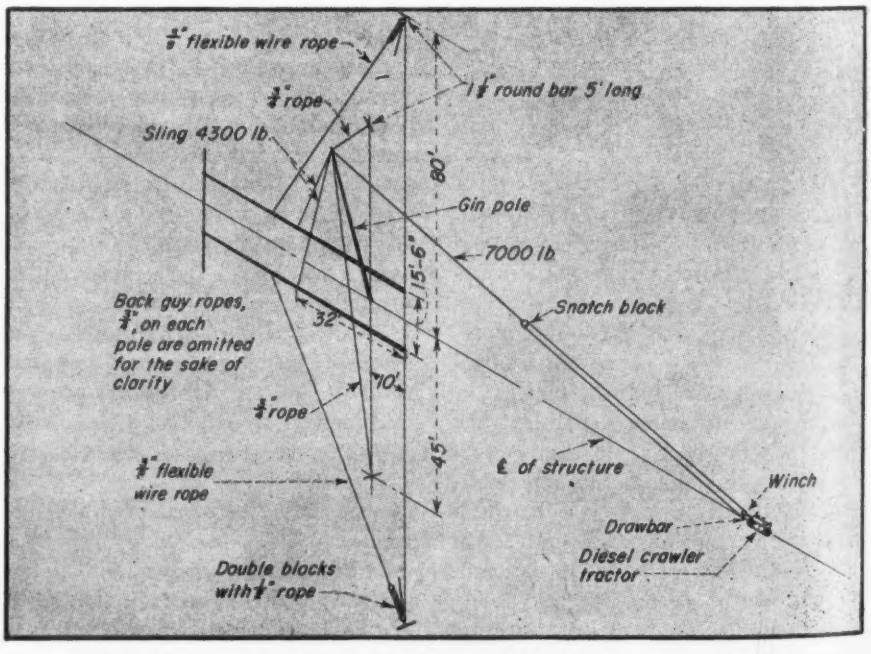
• • •

Development of a Method for Raising H-Type Structures

D. STEWART
Inspection Engineer
And H. J. FUNK
General Line Superintendent
Potomac Edison Co.
Hagerstown, Md.

ON 23.5 miles of 69-kv. line, a problem presented was the erecting of more than 200 line structures assembled on the job and constructed of Class 2 creosoted pine or Western red cedar poles in lengths ranging from 55 to 70 ft. and connected at top by double crossarms. Suitable derrick trucks were not available. Falling-gin method here outlined had been used only to a limited extent.

To use the falling gin, the "development" consisted of calculation of



LAYOUT of equipment used to erect 8,000-lb., H-type structures

stresses involved for the following conditions:

(1) Butt of gin pole midway between and—

(a) In line with pole holes.

(b) 5 ft. from pole holes.

(c) 10 ft. from pole holes.

(2) Angle of gin pole with horizontal from 40 deg. to 90 deg. in 10-deg. steps.

(3) Winch located 50 ft. and 100 ft. from pole holes.

The gin pole used was a 35-ft., Class 4, Western red cedar.

The work on the foregoing calculations was simplified by using a graphical solution and spot checking mathematically. Initial conditions were:

(1) Butt of gin pole on center line of structure 10 ft. from center of pole holes toward top of structure.

(2) Gin pole at angle of 70 deg. with horizontal, inclined toward top of structure.

(3) Winch at a distance of 100 ft. from pole holes.

Under these conditions, the calculated stresses based on weight of structures consisting of two 60-ft., Class 2 creosoted pine poles and a 35-ft., Class 4 creosoted pine pole crossarm complete with insulators (total weight approximately 8,000 lb.) are:

(1) Slings, from gin pole to poles on structure, 4,300 lb. on each.

(2) Compressive load on gin pole, 10,500 lb.

(3) Winch line, 7,000 lb.

In the field, with all material delivered, structures were assembled and erected in approximately 1½ hr., using a 16-man gang and caterpillar tractor. One three-pole structure was erected by using two gin poles, caterpillar tractor and truck with winch.

Steps in the erecting of the structures were illustrated in ELECTRICAL WORLD, August 31, 1946, page 82.

• • •

CO Relay Helps Decide Discarding of Old Meters

B. V. SHEPHERD
Meter Superintendent
Consumers Public Power District
Lincoln, Neb.

SEVERAL investigations and surveys have been made by various utilities, including our own, to determine the demand, load factor and kilowatt-hour usage of the small consumer. From the data obtained, recommendations have been made to the effect that, when a customer's meter shows a usage of a certain number of kilowatt-hours per month, there was a certain loss due to the meter size or the characteristic of the meter. However, most of the conclusions and recommendations were made from the use of empiric factors. There was too much assumption and supposition used in the various recommendations.

Before entering into a wholesale condemnation of some 40,000 old 5-amp., 2-wire meters, we wanted to know just how many kilowatt-hours were actually used at a current value at which the registration curve of the meter dropped appreciably. We wanted to know if the percentage was great enough to warrant the condemnation of the meter.

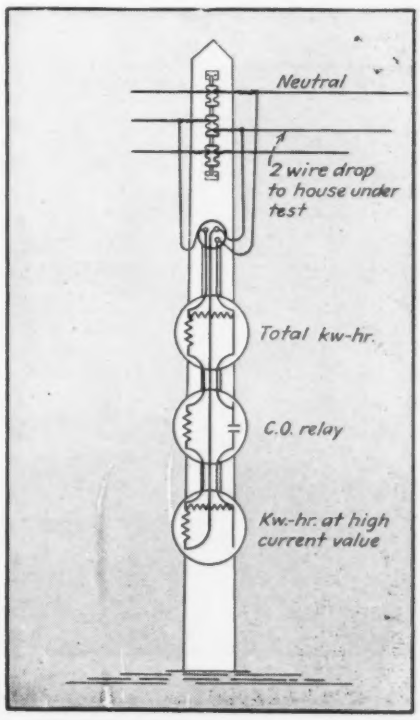
To obtain the desired information an inverse time limit, or over-current relay, was mounted in a socket type meter base. We used the Westinghouse type CO relay mounted in a base formerly used for converting type OA 2-wire meters into the socket type. The conversion was fairly simple and the same procedure was followed as utilized in the conversion of OA meters. The mounting ears were sawed off, in order for the cover to go over the relay. The relay contactor switch and target indicator coil were removed and it was necessary to mount the torque compensator above the current tap block. The relay was set on a current tap of 8 and a time lever setting of 2, and the relay so connected that, when the relay contacts closed, it would energize the potential coil of a 2-wire meter and thus register all usage at 8 amp. or above. Another meter was connected to register the total consumption. In this way, simultaneous readings could be obtained and the percentage could be accurately calculated.

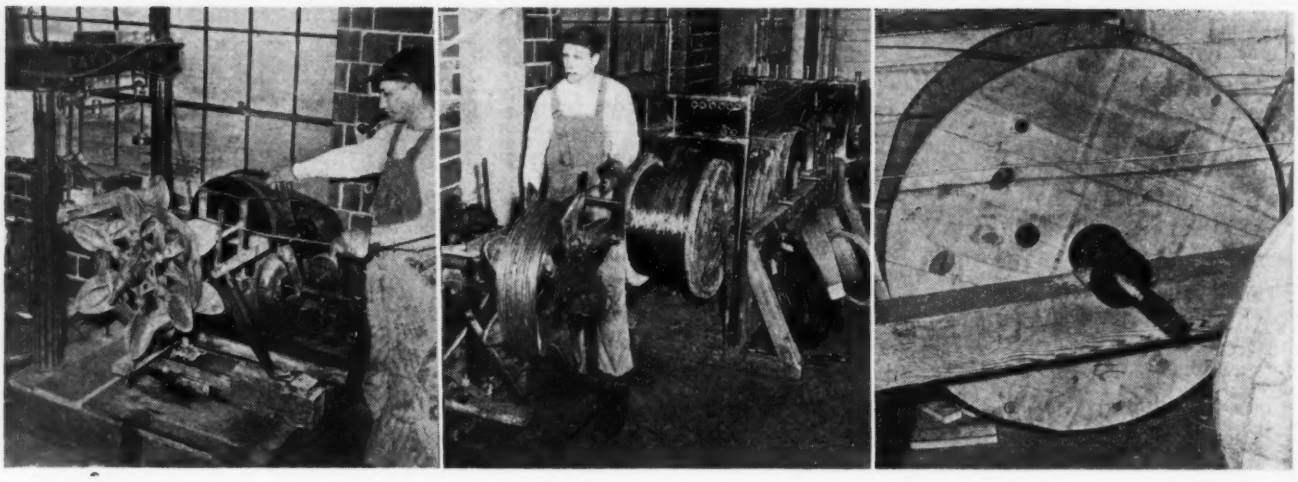
The equipment is mounted on a distribution pole where several 2-wire drops or services could be investigated without moving the equipment and, by using a totalizing meter, it was not necessary to coordinate the reading of the peak meter with that of the customer's.

At first we were fearful that the coils and wire of the relay would not stand a sustained overload, but tests with 25 amp. on the 8-amp. tap for 48 hours continuous load indicate the heating is not excessive and should serve our purpose in the field safely.

Advantage of this equipment is that it is flexible to the point that the various taps make it possible to investigate load conditions at any predetermined current value. The investigation can be made without arousing suspicion and thus a true picture of the actual load conditions can be obtained. Several investigations can be made from one installation, thus eliminating excessive moves of the equipment; also, the investigation can be made over whatever period of time seems advisable, without coordinating the readings with that of the regular meter reading.

ACTUATED by the relay the lower watthour meter registers all consumption in excess of 8 amp.





COLLAPSIBLE reel and power drive mounted on bed of large scale (left) are counterbalanced by adding weight to holder on scale beam. Wire from any one of 20 reels (center) is weighed out to the exact pound. Right: Reel and axle arrangement for holding coils of wire that come from supplier

How Storeroom Issues Wire to Exact Pounds

THE PROBLEM of how to weigh wire conveniently and quickly recently came up in connection with a new procedure adopted by The Washington Water Power Co. for issuing material in exact quantities for line jobs in suburban divisions. General Storekeeper R. D. Williams devised the system of weighing and wire handling shown by the accompanying illustrations. A power-driven collapsible wire reel was mounted on the bed of a large scale as shown. This was exactly counterweighted by adding more shot and some washers to the weight holder on the scale beam.

For any given weight of wire called for, the scale is set and the wire wound onto the reel until the scale balances. The 20 reels shown, 16 of them made for the purpose, contain all types and sizes of wire, including guy strand, ordinarily issued by the storeroom.

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Differential Protection, Delta-Wye Transformer Banks—IV*

JOSEPH M. DE GUILMO
Substation Department, Public Service Electric and Gas Co.,
Jersey City, N. J.

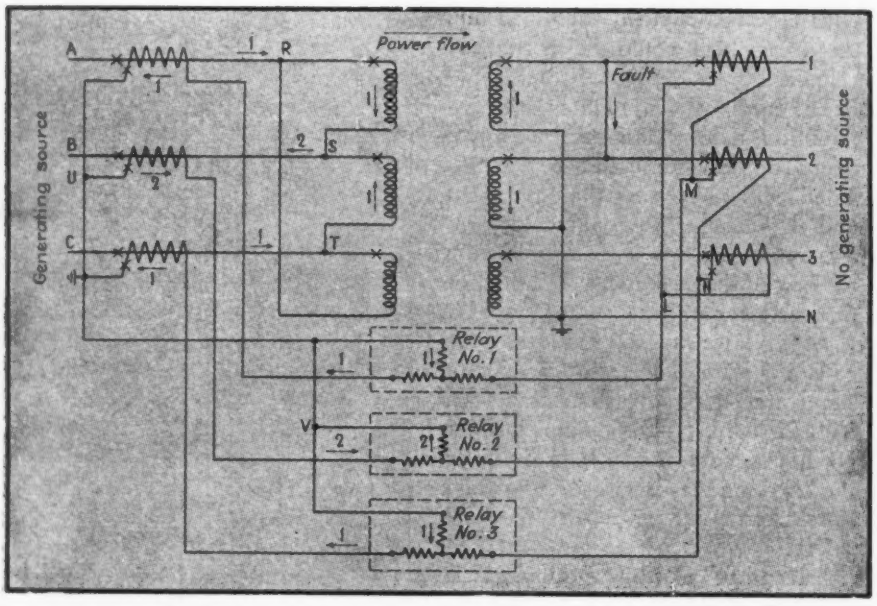


FIG. 4—Current flow due to an internal fault

SECOND STEP in verifying the connections is to see if the relays will trip for a fault in the area protected by the current transformers. Fig. 4 illustrates a short circuit between phase 1 and phase 2 in the zone protected by the relays. The fault currents in the transformer windings and in the line leads will flow as illustrated in the same manner as in the previous problem. Since the fault is internal there will be no current flow in the delta-connected current transformers. The result is that the currents from the star-connected current transformers cannot circulate through the restraining coils but are forced to make their return path through the operating coils as shown. Phase 1 and phase 3 relays have 1 amp. through

* Concluding the series which began in ELECTRICAL WORLD, August 3, 1946, page 74.

Readings on Relay Phasing

RELAY NO.	RESTRAINING COIL				OPERATING COIL	
	LEFT		RIGHT			
	CURRENT	ANGLE	CURRENT	ANGLE	CURRENT	ANGLE
1	1.0	40 deg.	1.0	40 deg.	0.0	—
2	1.0	280 deg.	1.0	280 deg.	0.0	—
3	1.0	160 deg.	1.0	160 deg.	0.0	—

their operating coils and phase 2 relay has 2 amp. through its operating coil. Therefore a relay operation will correctly take place for this fault.

Besides the fault analysis method of proving the correctness of connections, a phasing check must be made of all three relays while the transformer is carrying load.

In order to make this check a phase meter is connected in series with an ammeter as shown in Fig. 5. A schematic connection of one of the relays is illustrated which shows the current flow in the relay restraining coils when power flow is from star side of bank to delta side of bank. A steady reference voltage is placed on the phase meter potential coil. The current leads of the phase meter are polarized as shown.

To read the current entering the relay from the star-connected current transformers, the polarity wire of the phase meter is placed on the bottom of the test switch and the non-polarity wire is placed on the left-hand relay stud. The switch is then closed with a cambric tape "splitter" installed in the left-hand blade whose current it is desired to read. The splitter forces the current to flow through the ammeter and phase meter on its path through the relay. The current and angle are read and recorded. The equipment is then removed and installed in series with the current, leaving the right-hand restraining coil with polarity marks placed as shown.

If the current transformer ratios were such that they compensated for the ratio change of the main bank, the right-hand restraining coil current should be equal to and in phase with the left-hand restraining coil current. In this case, the current in the operating coil could be measured and it would be found to be zero.

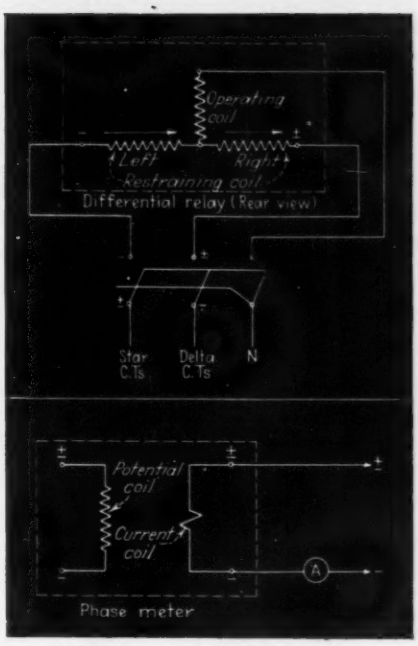


FIG. 5—Phasing check for relays

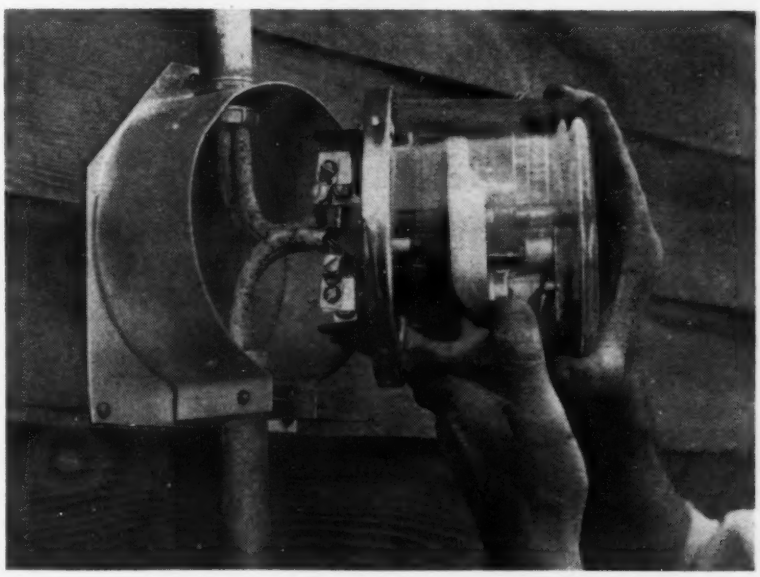
A typical phasing report is shown in the accompanying table. This tabulation verifies all our connections for the following reasons: (1) Current in left-hand restraining coil is equal in magnitude and in phase with the current in right-hand restraining coil. (2) The currents in all three phases are 120 deg. apart from each other.

• • •

Temporary Socket Beats Meter Base Shortage

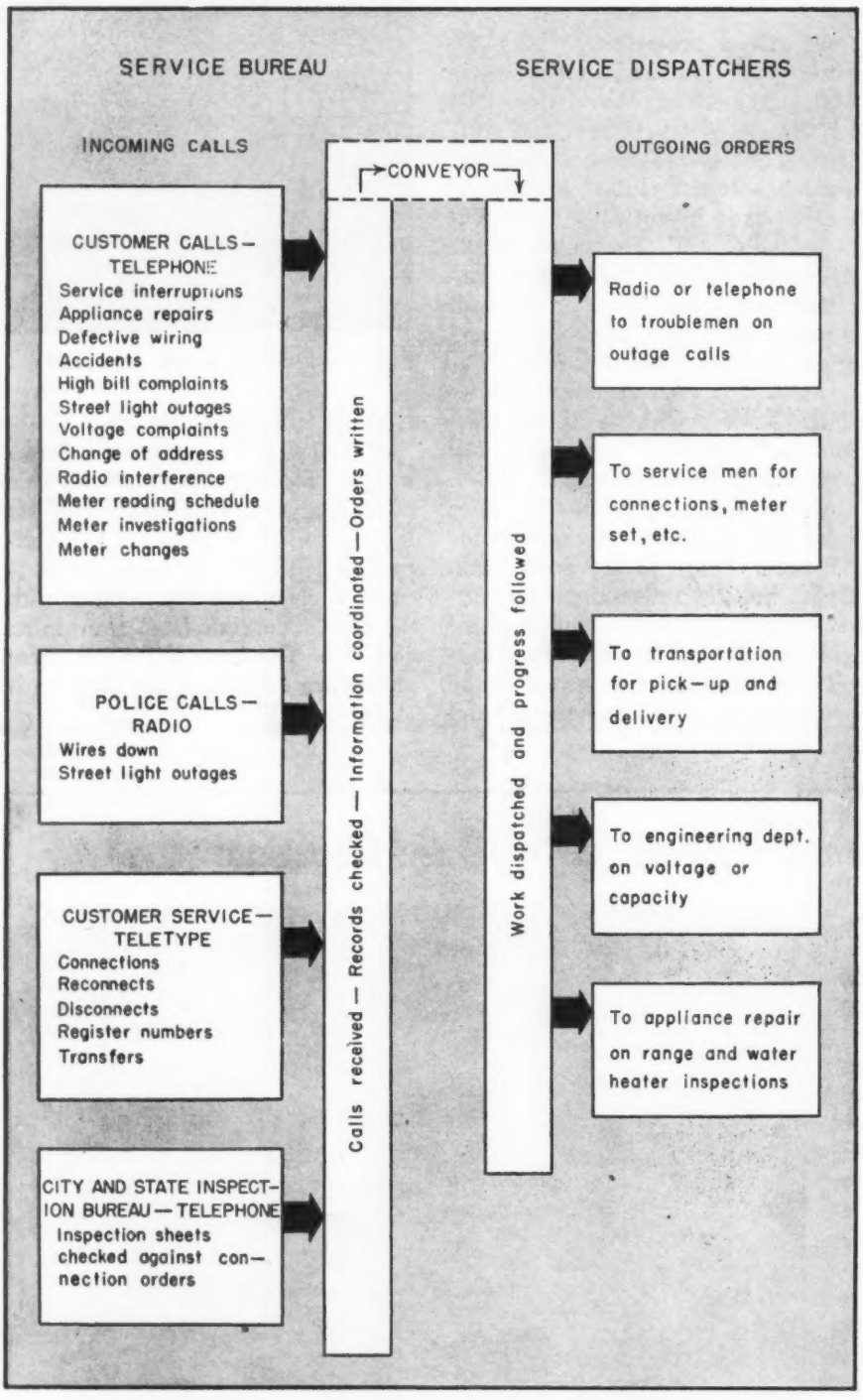
SHORTAGE of meter sockets has led Robert E. Marshall of the California Electric Power Co., Riverside, Calif., to develop the temporary socket illustrated. It consists of a 3¾-in. wide galvanized strip formed as shown and brazed in the upper portion to a wall plate of the same material. Indentations in the band hold the meter securely when the clamping screw is tightened. A hole is cut in the top by the wireman for the service entrance conduit. Outgoing conduit simply enters below as indicated. The base is rain-proof.

Two pounds of metal at 10 cents a pound and 20 cents worth of labor is the total cost. Connections to the meter are made with four reclaimable clamp lugs so as not to damage the blades.



FORTY CENTS is the total cost of this temporary meter socket

How A Service Bureau Centralizes Customer Calls



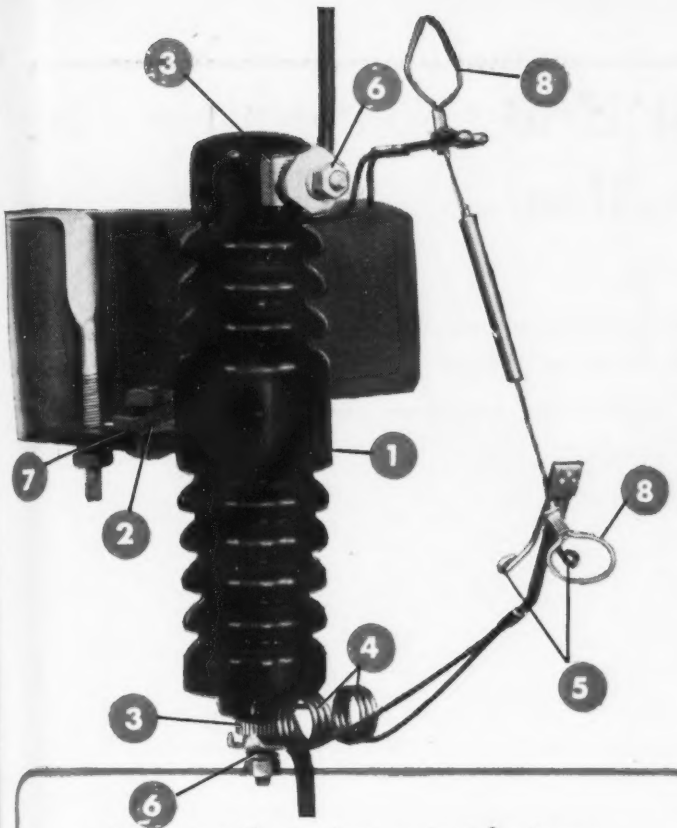
REPRESENTATION of flow of incoming calls and outgoing orders

An arrangement for handling telephone, radio and teletype calls and issuance of orders for the ultimate aim of providing electric service to customers.

A. F. AUGUSTINE
Supt. Transmission & Distribution
Indianapolis Power & Light Co.
Indianapolis, Ind.

ALL TROUBLE and service calls and orders from customers and between departments flow promptly to the point of dispatching through the service bureau of Indianapolis Power & Light Co. The arrangement has held to a minimum the transfer of customer calls from one department to another, and it helps to expedite connection or restoration of service as well as all other repair and order work.

Several forms are used to suit the type of calls received at the service desk. Outage calls go immediately to the trouble dispatcher. Orders from the commercial offices are delivered by teletype and customer connections are checked from the records before being sent to the service dispatcher. Transformer capacity and other information is obtained from the engineering department on larger lighting and power increases.



Improved

G-E FLIP-OPEN FUSE CUTOUT

7500/12500 Grd Y and 15000 Volts, 50 Amperes

For Rural Service

This improved G-E Flip-open fuse cutout of simple construction, provides inexpensive primary fusing for rural line service—where circuit conditions impose a less severe interrupting duty on the cutout, and where the advantages of the conventional hinged fuseholder type of cutout may be dispensed with.

This cutout provides over-current protection by means of a fuse link, without a hinged fuseholder tube. Expulsion action is obtained entirely by the fuse link tube—a unitary part of the fuse link. The fuse link is supported in tension between spring contact arms, which pull the lower cable terminal out of the fuse link tube when the fuse link melts.

A complete description of this improved G-E Flip-open cutout for rural service, Bulletin GEA-4224, may be obtained through your G-E representative or by writing to Apparatus Department, General Electric Company, Schenectady 5, N. Y.

You get these important features in the G-E Flip-open fuse cutout

1. ***Wet-process solid porcelain insulator,*** with undercut petticoats, provides for greater insulating strength.

2. ***Mounting support cemented in back of porcelain insulator,*** makes cutout virtually birdproof against short circuits from fuse contacts to hanger, thereby preventing unnecessary fuse blowings.

3. ***Terminal studs, supporting fuse contacts,*** are cemented in porcelain insulator, providing increased strike distance from live parts to hanger. Also assures positive location and non-twisting alignment of fuse contact arms.

4. ***Helical-wound, nickel plated, double coil springs*** of strong copperweld steel retard sideway of contact arm and avoid vibration stresses on the fuse link. These assure proper tension on fuse link and positive separation of blown fuse when fault occurs.

5. ***Double-wedge contacts, nickel plated,*** permit fuse link to be inserted from either side of the cutout. Contacts grip the fuse link cable with heavy pressure, securely holding the cable ends after fuse link has blown.

6. ***Exceptionally strong clamp-type terminals*** each provide for positive clamping of either one or two conductors No. 1/0 or smaller.

7. ***Mounting of cutout to hanger bracket*** enables side-swivel, vertical or angle-tilted mountings. Shakeproof lock washer securely holds cutout in mounted position.

8. ***Fuse-link with ring loop at each end*** enables easy insertion or removal with switchhook. Either Hi-Surge, or conventional types of Flip-open fuse links, are applicable.

406-19-5600

GENERAL ELECTRIC

Nomographic Solution for Heat Dissipated by Free Convection

J. P. C. McMATH, Northern Electric Co., Ltd., Montreal, Canada

Accompanying two monograms are an aid in determining the heat dissipated by free convection from long horizontal cylinders in air at atmospheric pressure.

FOR BARE or insulated cables or buses installed in "still" air and for the range of the variables normally encountered in current carrying capacity problems, the watts loss per foot length can be calculated by the well known formula [a]:

$$W_e = \frac{7.60 \times 10^{-6} \times \pi \times 12\ T_a^{0.764} \cdot \Delta t}{\log_{10}\left[\frac{0.0031\ T_a^{0.947}}{d^{0.51} \cdot \Delta t^{0.27}} + 1\right]}$$

The calculation is facilitated by using the charts and includes a factor Q.

Fig. 1 solves the factor Q

$$Q = \frac{0.0031\ T_a^{0.947}}{d^{0.51} \cdot \Delta t^{0.27}}$$

Fig. 2 solves the formula

$$W_e = \frac{7.60 \times 10^{-6} \times \pi \times 12\ T_a^{0.764} \cdot \Delta t}{\log_{10}(Q + 1)}$$

The nomograms may be used to solve, with sufficient accuracy, a similar formula [b] for watts loss per foot length.

$$W_e = \frac{7.60 \times 10^{-6} \times 12\ T_a^{0.764} \cdot \Delta t}{\log_{10}\left[\frac{0.00438\ T_a^{0.877}}{d^{0.75} \cdot \Delta t^{0.25}} + 1\right]}$$

A procedure for calculating the current carrying capacity of conductors in "still" air and a comparison of results by calculations and by nomograms will be presented in a subsequent issue.

In the foregoing formulas

W_e = Watts loss per foot length due to free convection
d = Conductor diameter, inches
T_a = Ambient temperature, degrees Kelvin
T_c = Conductor temperature, degrees Kelvin
T_a = Average of ambient and conductor temperatures
= $(T_c + T_a)/2$, degrees Kelvin
Δt = temperature rise = $T_c - T_a$

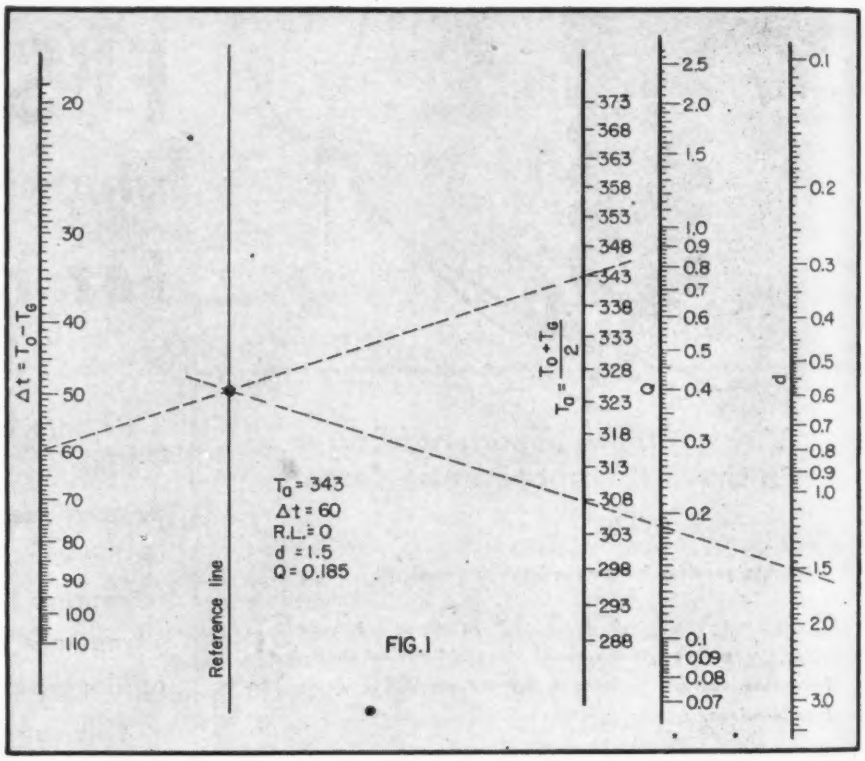


FIG. 1

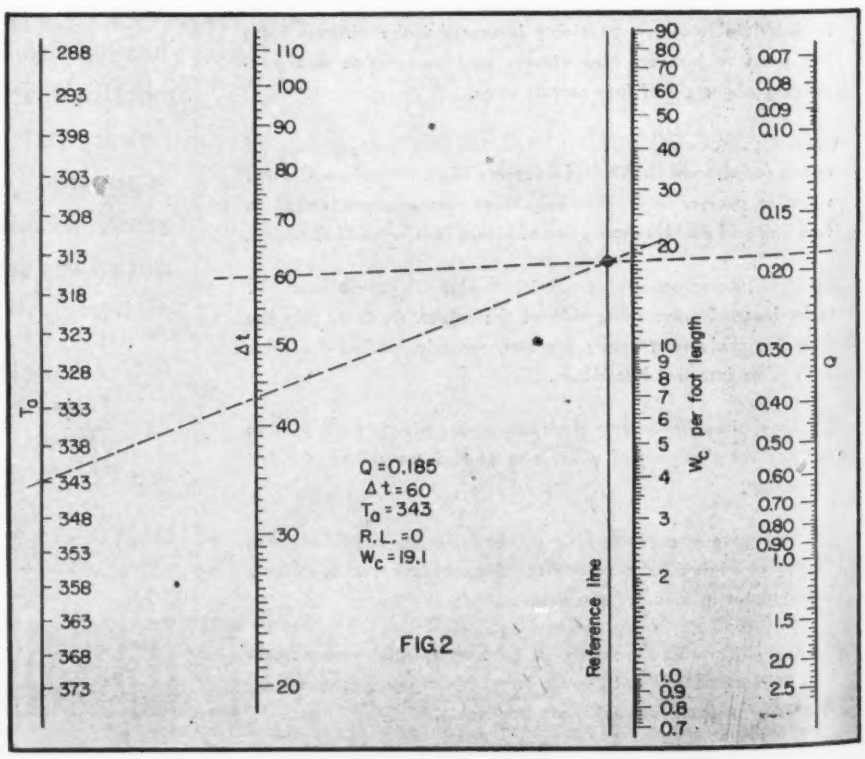


FIG. 2

[a] *Schurig, O. R. and Frick, C. W.: "Heating and Current Carrying Capacity of Bare Conductors for Outdoor Service," "General Electric Review," March, 1930.*

[b] *Enos, H. A.: "Current Carrying Capacity of Overhead Conductors,"* ELECTRICAL WORLD, *May 15, 1943.*

this Great New Book

RADIO . . . MAGAZINES . . . NEWSPAPERS . . . ALL WILL SELL YOUR CUSTOMERS

General Electric believes this to be the greatest promotion of its type ever offered to the electrical retailer.

It will bring traffic into your store—*and* sell G-E appliances.

This sensational new G-E book—"*Planning Your Home For Better Living—Electrically*"—is the only *complete* guide to modern electrical planning for the entire home.

It has more than 140 full-color illustrations showing how to use G-E's full line—13 sparkling Kitchens—6 work-saving Laundries—exterior and indoor Lighting—Air Conditioning—Basement and Recreation Rooms. It shows G-E products installed in *every room* of the home.

HOME BUYERS—will find this book a reliable evaluation reference when planning to purchase a house.

HOME BUILDERS—will find it an invaluable help during basic planning and when equipping their homes.

HOME REMODELERS—will find that this great new book helps them avoid many costly mistakes.

Everyone Will Hear About "Planning Your Home—"

RADIO—Each listener of the "G-E House Party's" national audience is being told about this new electrical guide.

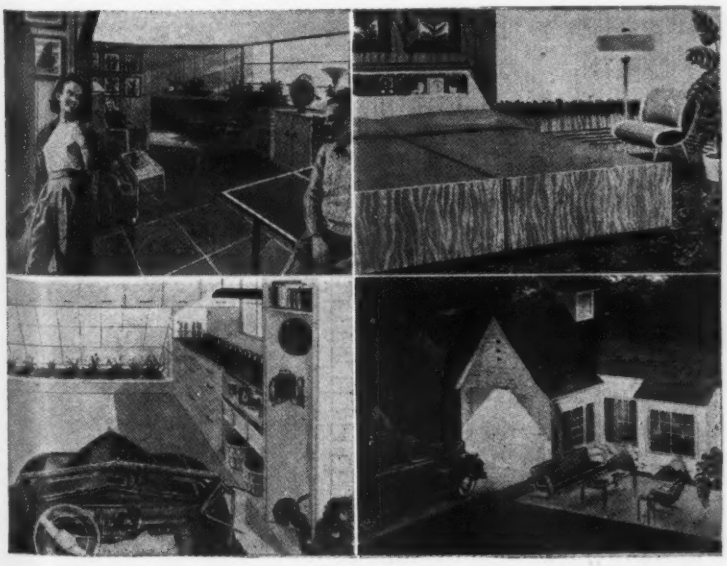
READERS—In *The Saturday Evening Post—Collier's*—and *Life*, many G-E ads will talk about this book.

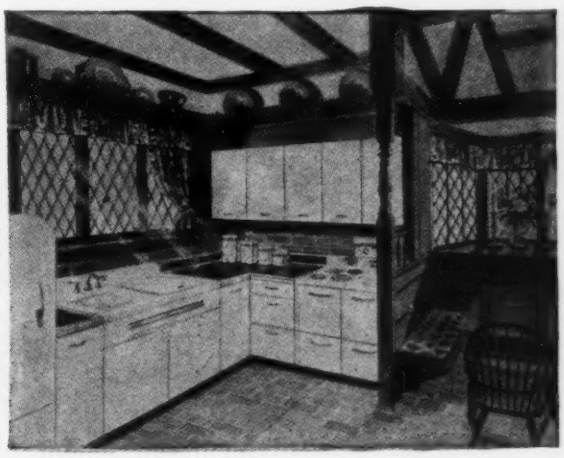
LOCALLY—G-E Distributors will have available specially prepared newspaper ads, announcements for local radio programs—and free blotters and mailing pieces.

Your Prospects and Customers Will Ask For It

This promotion directs prospects to your store. You'll have lots of requests for "Planning Your Home—." Have it on hand so none goes away disappointed. Price, 25¢.

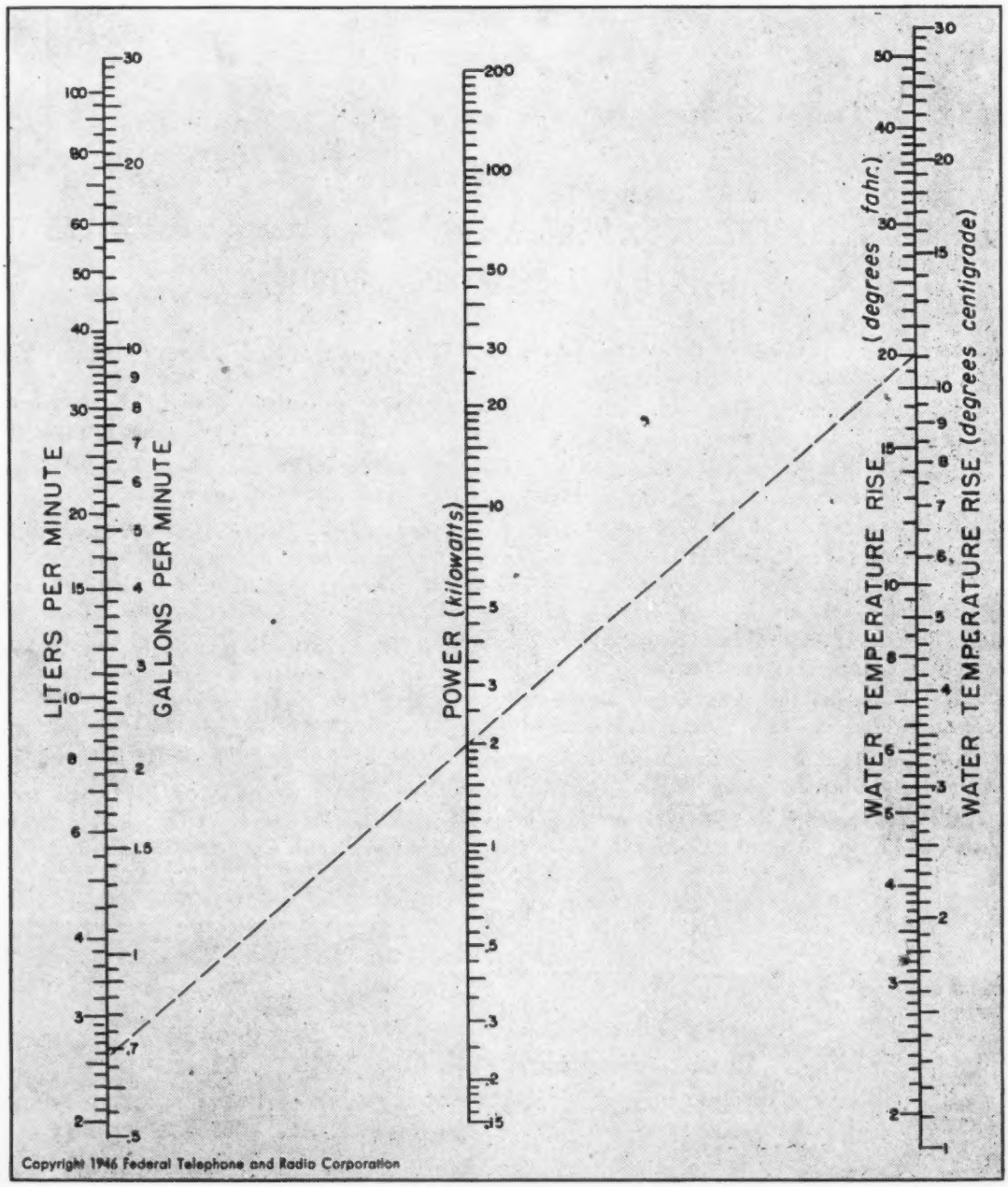
Order a supply from your G-E Distributor so that you'll get full benefit from this great sales-booster. Home Bureau, General Electric Company, Bridgeport 2, Conn.





How to Determine Power Dissipated in Water-Cooled Devices

H. W. BAKER, JR., Engineer, Vacuum Tube Engineering Department, Federal Telephone & Radio Corp., New York


LITERS PER MINUTE
GALLONS PER MINUTE
POWER (kilowatts)
WATER TEMPERATURE RISE (degrees fahr.)
WATER TEMPERATURE RISE (degrees centigrade)
Copyright 1946 Federal Telephone and Radio Corporation

Power dissipated in a water-cooled device is:

$$P = 0.264\, q_G\, \Delta t_C = 0.147\, q_G\, \Delta t_F = 0.069\, q_L\, \Delta t_C$$

where P = power dissipated in kilowatts
q_G = water flow in gallons per minute
q_L = water flow in liters per minute
Δt_C = temperature rise in degrees C.
Δt_F = temperature rise in degrees F.

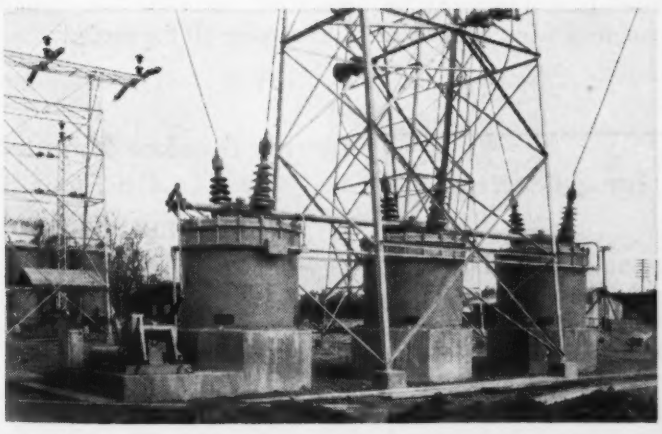
Example:

Find the power dissipated if q_G is 0.68 and Δt_F is 20 deg.

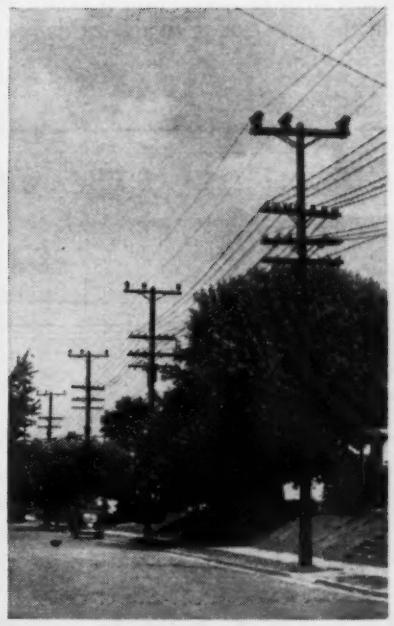
A straight line connecting 0.68 on the Gallons-per-Minute scale with 20 deg. on the Water-Temperature-Rise scale in deg. F. intersects the Power scale at 2 kw.

WHEN YOU KNOW

it!

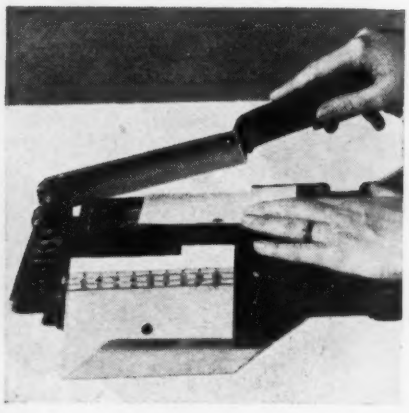


These O-B oil-filled, porcelain insulated bushings have served on this set of 110-Kv., heavy-duty breakers for 20 years with complete success.



In 1927--19 years ago--this 23-Kv. line was built using O-B pintype insulators taken down from a previous line with eleven years' prior service. All told, the insulators have delivered 30 years of good service in two different locations.

Test Status of Meters Shown by Simple Coding of Cards



TEST cards (above) are code-cut with right angle off-set cutter blade. Two ⅜-in. strips are cut from top of cards in ½-in. steps to make cards last ten years

UPPER edge of meter test cards (left) cut off in ½-in. steps correspond to one-year periods. Transparent year scale, shown, indicates year when meter was last routine tested

R. J. McKNIGHT

Central Arizona Light & Power Co.,
Phoenix

TO BE ABLE to recognize at a glance from looking at the meter test card file those meters that should be tested, Central Arizona Light & Power Co. code cuts the upper edge of the cards in the manner shown. The cutter illustrated is used to cut multiples of ½ in. from the upper edge of the cards from right to left to correspond to one year intervals. Test cards are filed in routes and coding indicates the test status of each individual meter as well as the route as a whole. Thus the test status of the system's 45,000 meters can be determined almost at a glance.

When cards are to be drawn from the file for test, the transparent year guide card shown is used to save time and avoid error in picking the cards. A home made cutter equipped with guides and stops cuts the cards in one stroke. This method of maintaining visual test status is obviously simple and effective and is much preferred to previous methods used, which included maintaining a test record book and use of flags or tabs on the cards. Flags or tabs were especially unsatisfactory because of difficulty in filing, bunching up in the file drawers and tabs coming off the cards.

• • •

Carbon Electrode Fixture Designed for Soldering

SMALL PARTS heated by bridging energized electrodes

A FIXTURE incorporating two carbon electrodes mounted in a Micarta panel has aided in the soldering of small parts by electric heat at the Mansfield, Ohio, plant of Westinghouse. The electrodes are mounted at an angle so that they can be bridged by small parts such as the copper strap terminal shown in the accompanying illustration. When current flows through the terminal, it is heated to the proper soldering temperature and solder is applied. A rheostat mounted under the bench regulates the amount of current used.

Circuit Breaker Mounted On Steel Panel

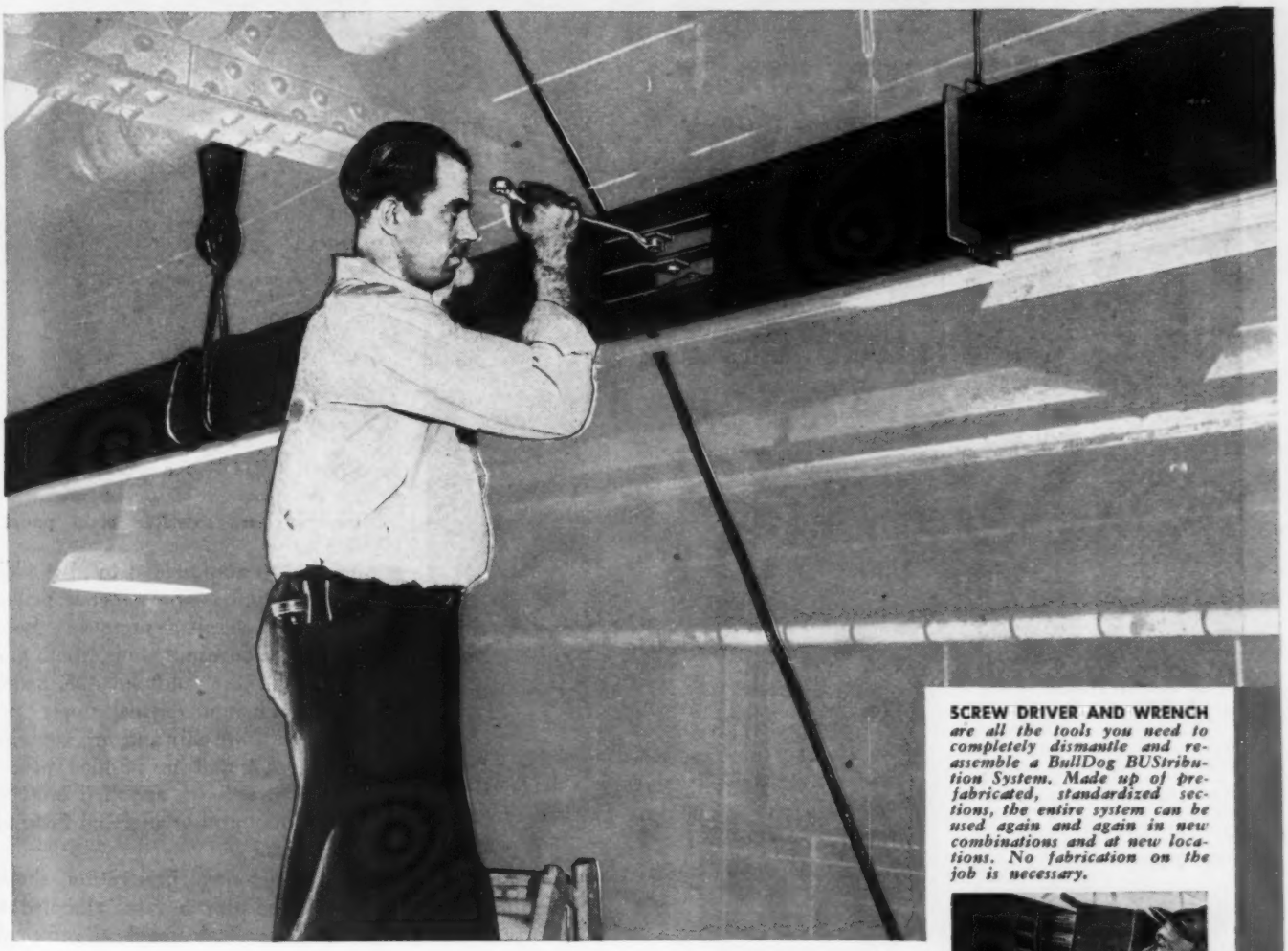
W. HAROLD EDMUNDS

Electrical Engineer
I-T-E Circuit Breaker Co.
Philadelphia, Pa.

THROUGH the development of a circuit breaker mounted on a steel panel for the U. S. Navy, a simplified and relatively inexpensive design has been made available for commercial, industrial and electric utility applications.

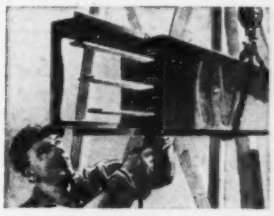
The panel is made of a special steel so as to decrease its magnetic effect on the operation of the circuit breaker. In the fabrication the edges

Power line relocated . . . all material salvaged



SCREW DRIVER AND WRENCH *are all the tools you need to completely dismantle and reassemble a BullDog BUStribution System. Made up of prefabricated, standardized sections, the entire system can be used again and again in new combinations and at new locations. No fabrication on the job is necessary.*

NO WAITING FOR POWER *with a BUStribution System—simply raise the plug to the nearest plug-in opening, snap its contact fingers over the busbar conductors and bolt the plug to the duct casing. The plug itself is a current protective device for the machine it serves.*



NO SCRAP WITH ANY MOVE! *There is no waste when you move a BullDog BUStribution System from one location to another. The component materials—steel duct, copper bus bars and vitreous porcelain—do not readily deteriorate and can be used indefinitely.*

Capacities: Feeder type—600 amps. to 4,000 amps.; Plug-in type—225 amps. to 1,350 amps.

You Can Do It With BullDog BUStribution DUCT

Manufacturers with an eye on tomorrow look to BullDog BUStribution DUCT for plug-in power supply, because this flexible bus duct system is *engineered for the future.*

"Moving day" in your plant can mean the time when your electrical system must be relocated, a new machine installed, or an old one shifted. In any case, BUStribution DUCT is ready for the change.

Built in standardized, prefabricated sections, it can be dismantled, moved and reassembled without scrapping a single nut or bolt. And when you shift a machine, the circuit protective plug moves right with it for easy mounting at the nearest plug-in opening. No cutting power . . . no tapping in "hot"—no lost production time.

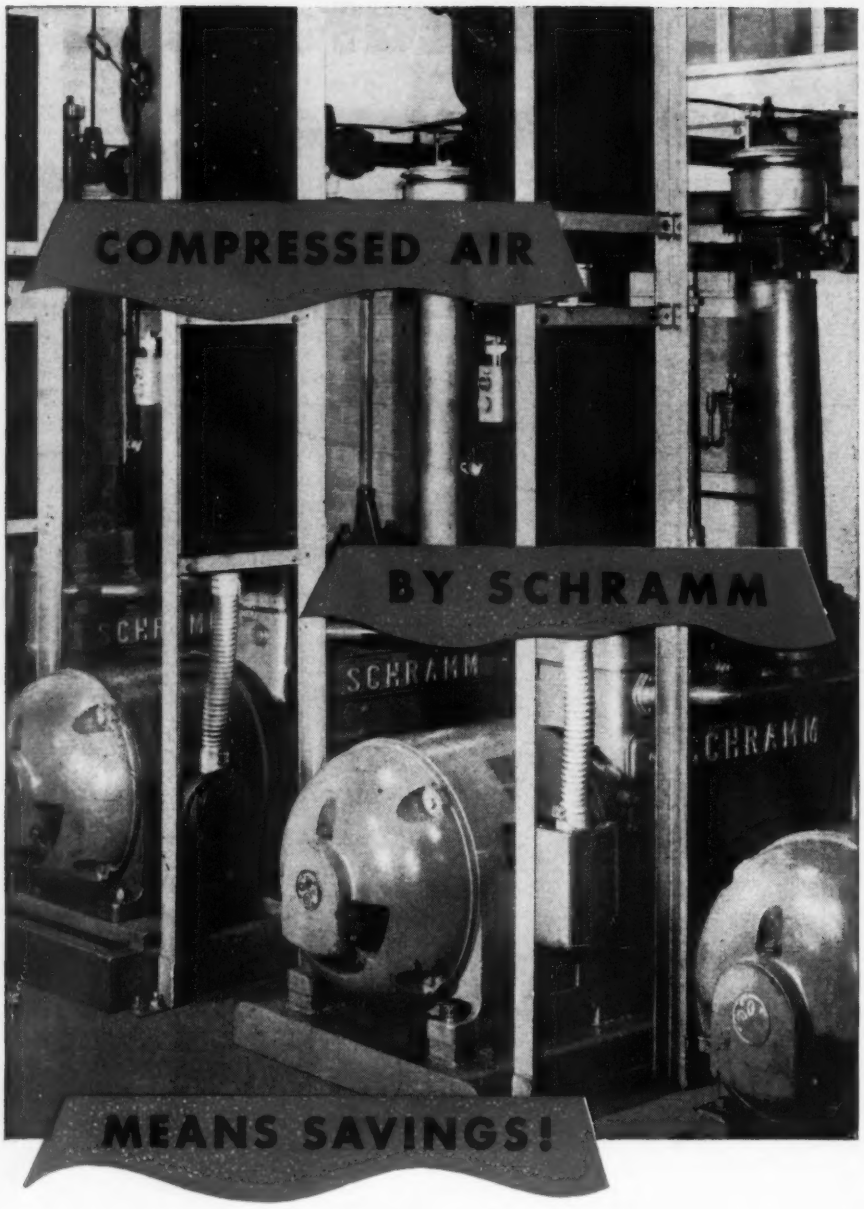
Write for detailed descriptive folders. Or, better still, consult a BullDog field engineer who can show you a BullDog installation near your own plant.

BullDog Also Manufactures Vacu-Break Safety Switches—SafToFuse Panelboards—Switchboards—Circuit Master Breakers—Industrial Trol E-DUCT for Portable Tools, Cranes and Hoists—Universal Trol-E-DUCT for completely flexible lighting.

BULLDOG

ELECTRICAL DISTRIBUTION SYSTEMS

BULLDOG ELECTRIC PRODUCTS COMPANY, BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN. In Canada: BullDog Electric Products, Ltd., Toronto. Field Engineering Offices in All Principal Cities



SAVINGS because you get all the
air you want—easily and economically
—with Schramm Air Compressors!

Schramm Air Compressors are compact, sturdy,
vibrationless . . . and offer such distinctive features
as 100% watercooled . . . mechanical intake valve . . .
forced feed lubrication . . . and easy starting.

Schramm offers you many savings, as industries
using Schramm have discovered. We invite
you to write us today for full descriptive catalog.
From it you will see the wide range of sizes
and models offered by Schramm, and what
unit best fits your needs.

SCHRAMM INC.
THE COMPRESSOR PEOPLE
WEST CHESTER
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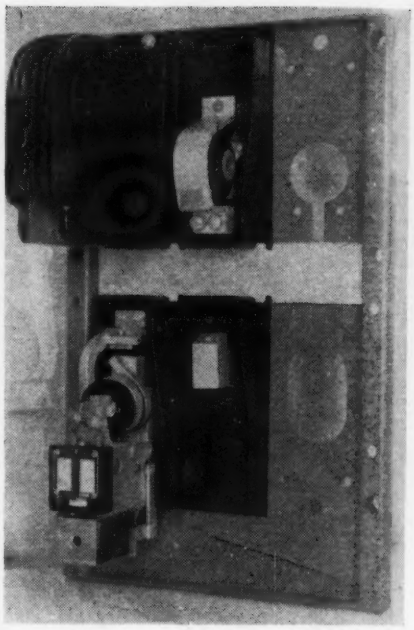


SOME UNITS of a circuit breaker in the process of being mounted on previously drilled steel panel

are bent up and welded to give additional strength. The panel is drilled for the mechanism mounting holes and for the terminal studs which protrude from the back of the panel. The overcurrent device, upper terminal, blowout coil and arc suppressor are mounted in molded plastic bases. These bases are then fitted to the steel mounting panel and fastened with screws.

Accompanying illustration shows some of the plastic bases mounted in place. The steel panel is protected from the arcing of the contacts when the circuit breaker opens, by placing a piece of melamine asbestos insulation across the panel in the arc suppressor section.

Some outstanding points of the development are:

(1) The design permits the manufacturer to make up subassemblies of the overcurrent device, upper terminal, and arc suppressor, thus increasing the assembly production rate of circuit breakers and reducing the stock problem.

(2) For the user, the simplified design permits the changing of overcurrent devices with a minimum amount of effort.

In general, this new design will also effect a change in the design of the switchboard. The presence of the steel panel will completely isolate the circuit breaker from the structure, and the circuit breaker will be completely surrounded by steel. Such a construction will prevent flashovers

SUPEREX by Solar

SUPEREX*, Solar's superb new oil-impregnant for paper dielectric capacitors, is the result of a long-time program of research and development. Its entry into mass production under rigid standards of quality control marks another Solar contribution to the electrical industry.

SUPEREX gives to the electrical industry a capacitor dielectric material with the following outstanding properties:

1. Low Power Factor
2. Long Life
3. High Flash Point
4. Non-Inflammability
5. Non-Corrosiveness
6. Stabilized for Operation at High Temperatures, 85°C for DC, 75°C for AC
7. High Insulation Resistance
8. High Dielectric Constant

NOW available to the electrical and electronic manufacturing industries after months of heavy pilot plant production and test by leading capacitor users in the United States, **SUPEREX** stands forth today as the ideal capacitor impregnant for most applications. Tests by those who have already used **SUPEREX** capacitors have won this new material unqualified approval.

*Trade Mark

SUPEREX assures outstanding performance in motor phase-splitting capacitors, energy storage capacitors, all light and heavy-duty capacitors used in communication and industrial electronic equipment, and in capacitors for power factor correction.

SOLAR has now completed a new plant for mass production of **SUPEREX** capacitors. This ultra-modern plant with the latest developments in high-vacuum processing equipment, is supplying daily increasing quantities of **SUPEREX** capacitors to those who need the utmost in capacitor performance and reliability

SOLAR will be glad to tell you how you can utilize the advantages of **SUPEREX** capacitors in your applications. A letter today will bring you the benefit of Solar's authoritative experience in solving capacitor problems.

P. S. Do you read The Solar System for regular news on developments in the capacitor field? If not, drop us a note to place your name on the mailing list without charge.

1844

SOLAR CORPORATION

PLANTS AT CHICAGO, ILL.; NORTH BERGEN AND BAYONNE, N. J.

THE ELECTRICAL AND ELECTRONIC INDUSTRIES

Now CRESCENT WIRES AND CABLES

Conforming to the 1946 National Electrical Code

GIVE YOU THE FOLLOWING ADVANTAGES

IMPROVED INSULATION

CRESCENT Building Wire—Type R, Code grade and Type RW Moisture-Resisting grade employ improved rubber insulation resulting in even longer life that permits a 60° C. maximum operating temperature instead of 50° C. as in the past.

SMALLER DIAMETER

Sizes #14 and #12 A. W. G., Types R and RH, employ a 1/32nd inch wall of insulation that gives a considerably smaller wire permitting more copper and current-carrying capacity for the same size conduit, for rewiring.

GREATER CURRENT-CARRYING CAPACITY

The use of CRESCENT ENDURITE Type RH Heat Resisting Cables in sizes #1 A. W. G. and heavier is recommended as they give the lowest cost per ampere of useful installed capacity and longest life.

EASIER TO INSTALL

CRESFLEX—Non-metallic Sheathed Cable is smaller, lighter and easier to install in sizes #14 and #12 A. W. G.

CRESCENT WIRE & CABLE

NEMA

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

or fires originating in one compartment from spreading to other parts of the switchboard. With this construction the safety factor of switchboards will be increased by a considerable amount.

All of the company's circuit breaker designs have not been changed to include the new steel mounting construction, but such work is currently in progress.

•

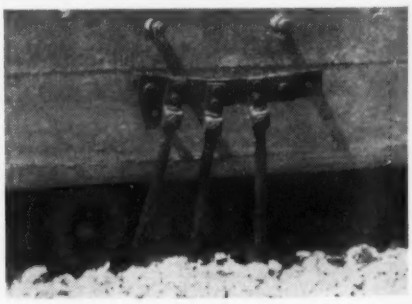
Flexibility Provided Between Solid Structures And Sinking Ground

B. D. DEXTER

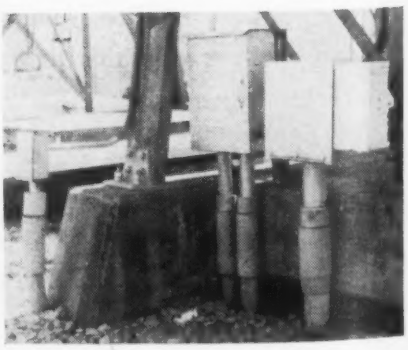
Pacific Gas & Electric Co.
San Francisco, Calif.

Problem—How to provide some degree of flexibility for conduits carrying control wiring between a fixed foundation and ground subject to settling is a problem occasionally encountered.

Solution—In such a case at one of its large distribution substations, Pacific Gas and Electric Co. solved the



WHAT HAPPENS when ground settles if no flexibility is provided between solid structures and ground subject to settlement. In this case no damage was done since only a ground cable terminal strip was involved



MOISTURE PROOF coupling of standard Transite parts prevents damage to wiring if ground sinks

WHY BUY
SO MANY
CARBON
BRUSH ITEMS?
STEEL COMPANY CUTS BRUSH ITEMS FROM 3370 TO 495
Makes big saving, weeding out unnecessary brush items and inventories

CHECK the number of motor and generator brush sizes and types your company orders and stocks. The number will surprise you. Even more startling, if you investigate further, is that a great part of this inventory is really unnecessary!

National Carbon Company, Inc., has launched a program of simplification and standardization to the greatest possible degree of carbon, graphite, and metal-graphite brush specifications. Eventually, the result of such effort will be the stocking of brushes of standardized types and grades.

It's a certainty that you can save money for your company by reducing the variations in brush specifications and by streamlining your brush orders and inventories. National Carbon Co., Inc., is ready to assist you in taking advantage of this program. Simply get in touch with our nearest Division Office today. Dept. EWD.

HOW BRUSH SIMPLIFICATION PAYS:

1. Price advantage through quantity discounts.
2. Reduction of small orders—saving time in bookkeeping, billing, and accounting.
3. Less money and space tied up in brush stocks.
4. Less time needed to handle stock.

The word "National" is a registered trade-mark of

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

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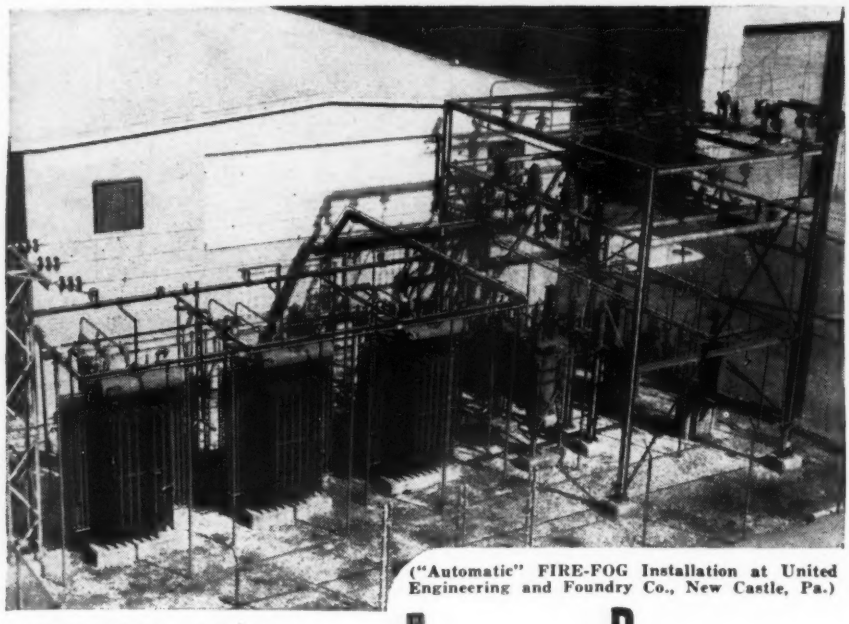
30 EAST 42nd STREET, NEW YORK 17, N. Y.

Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

Short Life . . TO TRANSFORMER FIRES



("Automatic" FIRE-FOG Installation at United Engineering and Foundry Co., New Castle, Pa.)

WITH SPLIT-SECOND "Automatic" FIRE-FOG Protection

★ IT BLANKETS ★ IT ISOLATES ★ IT QUENCHES ★

Only a hint of flame at this bank of high voltage electrical transformers and—*quick as a flash*, "Automatic" FIRE-FOG goes into action. From strategically located FIRE-FOG nozzles, a barrage of mist-fine water spray is directed at the blaze forcing the flames down and cooling the fire area. Seconds later, extinguishment is complete....final, and damage to equipment has been confined to the point of fire origin. Even out-of-service time has been held to a minimum.

In addition to safeguarding oil-filled electrical equipment from the danger of fire, "Automatic" FIRE-FOG provides positive protection for oil quench tanks, gasoline loading racks, dryers, oil lines and flammable liquid processing, handling and storage facilities. Write for complete information. It's yours for the asking.

THE SUPROTEX® SPRINKLER SYSTEM

—a famous member of the "Automatic Sprinkler Family. Designed particularly for use in manufacturing, mercantiles, warehouses, schools, churches, offices, hospitals, piers and other establishments where positive fire protection is essential.

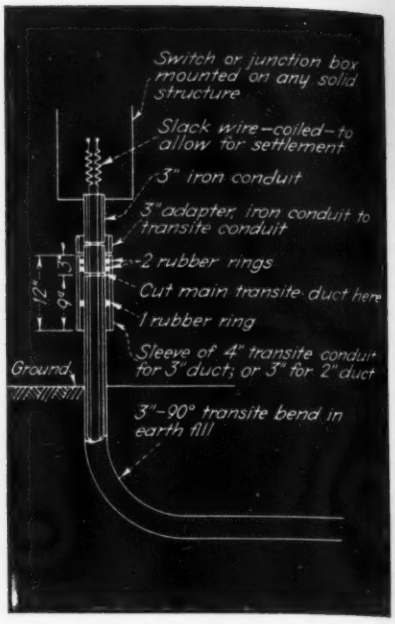
®Trademark Registered U. S. Patent Office

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . . . OFFICES IN 37 CITIES

"Automatic" Sprinkler designs, manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories


Switch or junction box mounted on any solid structure
Slack wire—coiled—to allow for settlement
3" iron conduit
3" adapter, iron conduit to transite conduit
2 rubber rings
Cut main transite duct here
1 rubber ring
Sleeve of 4" transite conduit for 3" duct; or 3" for 2" duct
Ground
3"–90° transite bend in earth fill

DETAILS of method used to terminate at pull-boxes or sectionalizing switches or any other fixed point where settlement of ground may take place

problem by use of standard Transite fittings as shown by the accompanying drawing and illustrations. This was a case where oil circuit breakers, transformers, bus structure, etc., were mounted on concrete slabs and beams placed on piling with surrounding ground subject to settlement from time to time.

Other means of solving the problem might have been found, but the method used appealed from the standpoint of simplicity and use of standard materials.

•

Visual Reminder

CHECK the multiplier! This is the significance to meter readers of Central Arizona Light & Power Co. of the red trim on the meter dial face shown. Despite the fact that dials show a multiplier and meter sheets show reading constants, occasionally an error still creeps in because there is nothing to make the multiplier conspicuous. Use of the red trim is a third telltale and has proved effective over a period of several years

Design Unshackled!

ALZAK* ALUMINUM'S EASY

Formability GIVES YOU FREE REIN!

The formabilty of Alcoa Aluminum Reflector Sheet gives you freedom of design; the metal is readily formed, spun, or drawn to carry out your own individual ideas for reflector or fixture design . . . and lighting efficiency. This formability is a big plus, when you add it to the other advantages of Alzak Aluminum Reflectors: corrosion and heat resistance, surface stability; in short, *sustained high efficiency*, for either specular or diffuse applications.

Consult your reflector manufacturer regarding specifications for Alzak Aluminum, or other finishes of Alcoa Reflector Sheet. ALUMINUM COMPANY OF AMERICA, 1978 Gulf Bldg., Pittsburgh 19, Pennsylvania. Sales offices in principal cities.

*PATENTED PROCESS

NEW CURTIS LUMINAIRE USES ALZAK ALUMINUM

For offices, drafting rooms, schoolrooms, the new Curtis "Forty-Sixty" Luminaire makes use of Alzak Aluminum's efficiency to direct approximately 40% of the light upward, 60% downward, provide ideal working light.

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM

IN EVERY COMMERCIAL FORM

DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards

Selective Protection For Transformer Stations

From a paper by C. Ramelot (Société Intercommunale Belge) before the Conference Internationale des Grands Réseaux Électriques, Paris, June 27-July 6, 1946.

PROTECTION of transformer stations and major distribution substations has received less attention than protection of lines, in the opinion of the author. The former is more difficult on account of the complexity of the installations and because the clearing time for severe faults should be of the same order as that for lines.

The starting element of the protection system may be actuated by current, voltage, or impedance of the circuit above the point of measurement. Ordinarily, where current is used it is futile to seek accuracy of measurement. Where the energy involved is sufficient, a simple iron split-ring relay mounted around a phase conductor can attract a keeper, thus closing contacts when a predetermined current is reached.

Technically the best method is to make the starting as well as the timing dependent on measurement of the fault impedance or reactance. Often the majority if not all the independent feeders have tripping times nearly equal, so that a single timing relay can be used. In a large substation feeders may be grouped according to their time constants.

Vitreous Enamel For Resistors

From an article in "Chemical and Engineering News," April 10, 1946.

VITREOUS ENAMEL for coating fixed wire-wound resistors has been developed at the Mellon Institute by the fellowship staff of the O. Hommel Co., acting for the Office of Production Research and Development of the WPB. The coating, which must withstand an operating temperature of 275 deg. C. and must not break down under rapid temperature changes, is made of a silicone paste originated by the fellowship of the Corning Glass Works. Upon curing, this material is of rubbery consistency and of such high elasticity that it is independent of the expansion of tube, wire and terminals.

The resistors are made with enameled steel tubes as insulating cores. Elements of low expansivity were made with zircon-porcelain tubes wound with Kovar wire attached to Kovar terminals of special design and coated with the silicone paste. Many resistors were made and tested in Army and Navy laboratories. They were found satisfactory for the most severe service imposed on communications equipment used in combat.

Tinning Steel Strip

From an article in the "Electrician," London, April 19, 1946.

IN a joint discussion before the Electrodepositors' Technical Society and the Institution of Electrical Engineers it was disclosed that the thickness of the tin coating of steel strip produced by the electrical process can be controlled far closer than with the hot-dip method. The latter requires a minimum of 1¼ lb. of tin per bas box (56 sheets 28x 20 in. or 112 sheets 20x14 in.), whereas the electrolytic deposit can be predetermined and adhered to with a precision unknown in the hot-dip method. Moreover, the process is continuous, which has not yet become practical with the hot-dip method.

The main problem in the electroplating is the method of supplying low voltage to the tanks. Motor-generators, which have been used for some time, are rapidly being replaced by rectifiers. The strip may be heated directly by passing current through it from conductor rolls or indirectly by eddy currents induced by a high-frequency generator. Photo cells are used in the control of the loops of sheet between the entry and the plating zone, and between the plating zone and the delivery end. They also are used to detect perforations in the steel plate.

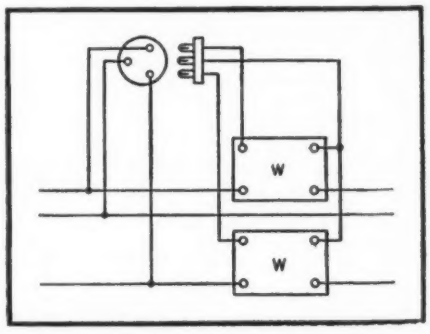
For thick coatings the cost of the two processes was said to be about equal. Uniform coatings of the order of 0.00003 in. and even of 0.000015 in. have been attained with the electrolytic process, which are far less than the usual thickness of 0.00009 with the hot-dip method.

Power Factor Of Unbalanced Loads

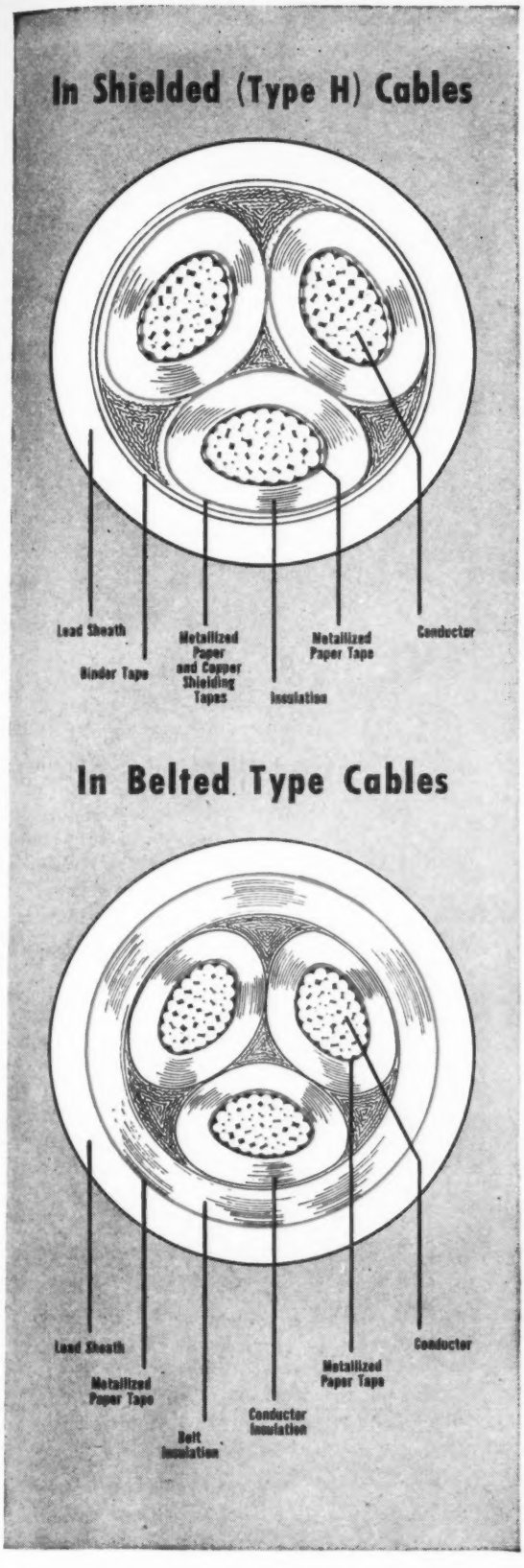
From an article by G. W. Stubbings in "Electrical Review," London, April 26, 1946.

MEASUREMENT of the power of an unbalanced three-phase circuit can be made with two wattmeters provided the line voltages are balanced, and the power factor can be measured by advancing or retarding the voltage connections of the wattmeters by 120 deg. The change may be made readily with a three-pin socket and plug, as shown in the diagram. If the power factor is known to be lagging the direction of phase shift is readily checked, as a lag of 120 deg. will make the meter in the lagging phase read higher.

The algebraic sum of the wattmeter readings, S_1, with normal connection, equals the power, P, of the load. Let S_2 be the algebraic sum of the readings with the voltages retarded 120 deg. Then $S_1 = P = V(I_1 \cos \theta_1 + I_2 \cos \theta_2)$,



CONNECTIONS for shifting voltages to obtain power factor



HOW TO IMPROVE PAPER INSULATED CABLES

with Keller-Dorian Metallized Paper Tape

HOT COPPER in contact with oil produces certain chemical reactions. In oil-impregnated paper-insulated cables operating at high temperatures, these reactions can hasten deterioration of the paper insulation.

But not if the cable is protected with K-D Metallized Paper Tape. Wrapped over the copper conductor, it sets up a *barrier* between the conductor and the insulation . . . keeps harmful impurities out . . . minimizes the destructive effects of the copper-oil combination . . . and gives your cables longer life.

And because it provides a smooth conductive surface under the insulation there are no concentrated points of electrical stress.

Ionization—caused by expansion of the lead sheath away from the insulation—is minimized. For K-D Metallized Paper Tape, wrapped over the insulation, keeps contact with it . . . short-circuits the space created . . . increases the dielectric strength.

Whether it's a belted or shielded type of cable . . . this tape will provide a lower power factor . . . greater breakdown values . . . increased safety factor . . . retarded thermal aging of the impregnated paper. Insure these advantages next time you order electrical wires and cables from your manufacturer. Specify them with Keller-Dorian Metallized Paper Tape protection. Keller-Dorian Corporation, Empire State Building, New York 1, N. Y.

KELLER-DORIAN

CORPORATION

EMPIRE STATE BUILDING, NEW YORK 1, N. Y.

METALLIZED PAPER TAPES FOR ELECTRICAL WIRES AND CABLES

You can depend on LONG, LOW-MAINTENANCE SERVICE with ORANGEBURG CONDUIT

ORANGEBURG CONDUIT has been used by the electrical industry for more than 50 years . . . *proving*, in practice, that it serves longer and better—with low first cost and less maintenance. ORANGEBURG* is strong, tough and light—easy to transport—easy to cut or work—simple to install.

Tight taper sleeve joints as well as impermeable walls prevent infiltration. Smooth bore protects against abrasion and strain when cable is pulled into duct—and as it expands and contracts under load. Safe against corrosion at the contact between sheath and duct.

The ORANGEBURG catalog is rich in worthwhile information. Write *today* for your copy!

THE FIBRE CONDUIT COMPANY • ORANGEBURG, N. Y.
Graybar Electric Co., Inc. • *Distributors* • General Electric Supply Corp.

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ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

where V is the line voltage, I_1 and I_2 and θ_1 and θ_2 the current and phase angle in the two meters respectively. With voltages retarded 120 deg., $S_2 = -\frac{1}{2}S_1 + \frac{1}{2}\sqrt{3}(VI_1 \sin \theta_1 + VI_2 \sin \theta_2)$. The quantity within the brackets is the sum of the wattmeter readings if the voltages were retarded 90 deg., or the reactive volt-amperes, Q. Thus $2S_2 = -S_1 + \sqrt{3}Q$, and $Q = (2S_2 + S_1)/\sqrt{3}$. Substituting $S_2 = nS_1$, $\tan \phi = (2n + 1)/\sqrt{3}$. and the power factor, $\cos \phi$, $= \frac{1}{2}\sqrt{3} \times 1/\sqrt{(n^2 + n + 1)}$.

A graph may be plotted for all values of n and $\cos \phi$ from which the power factor may be obtained for any readings without numerical calculation.

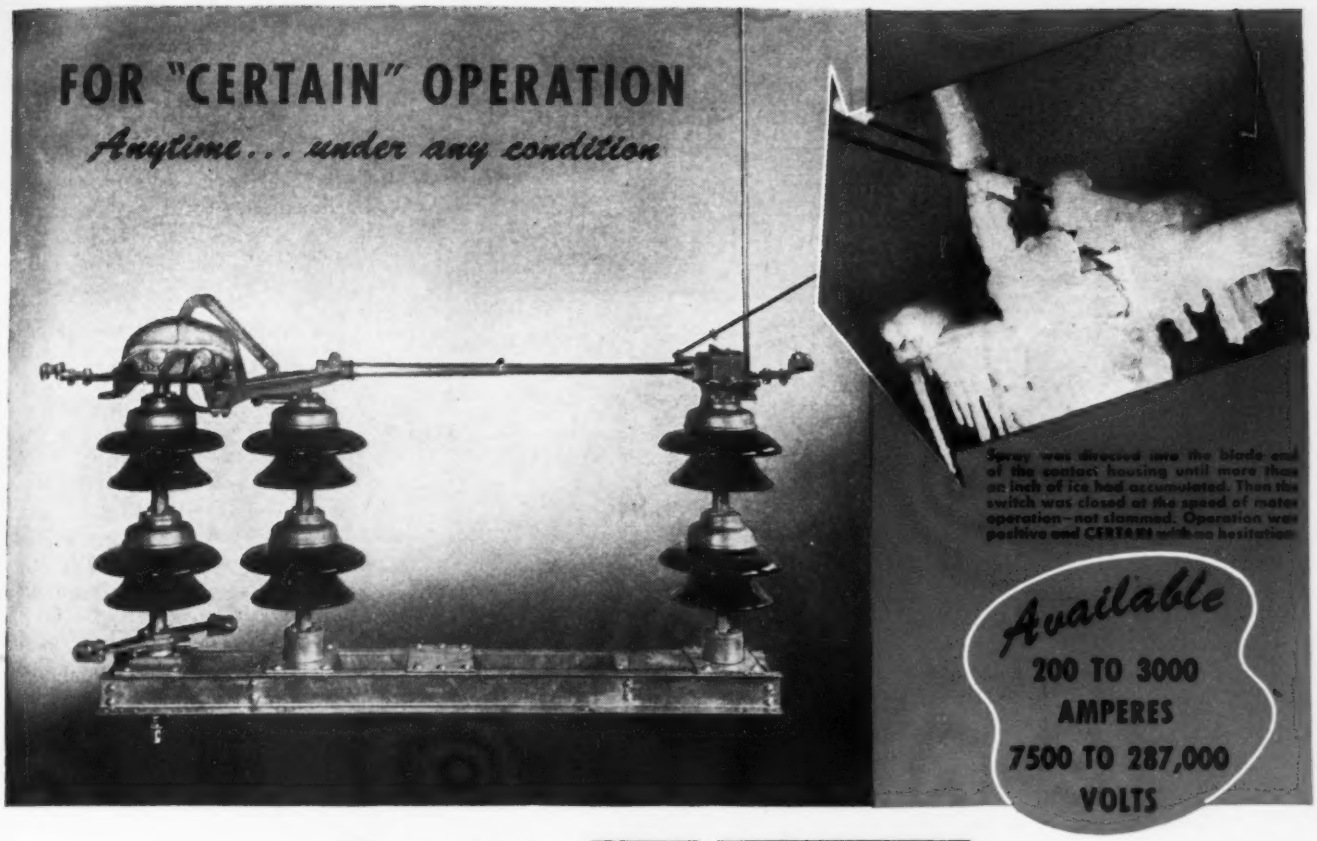
Theoretical Aspects Of Thunderstorms

From an article by O. H. Gish (Carnegie Institution) from "Transactions of 1944 of the American Geophysical Union."

CONSIDERABLE DOUBT exists as to the processes involved in generation of electrical charge during a thunderstorm. The cycle may be regarded as consisting of (a) initial small-scale separation of charge in which individual particles become charged with electricity of one sign and the adjacent air the opposite, and during which ions possibly may be formed in the center of the storm cloud; (b) large-scale separation of charged particles or ions from those of the other sign to distances of several kilometers; (c) initiation of discharge from a cloud, or mobilization of charges in individual drops widely distributed through some cubic kilometers at a rate and in quantity to supply the lightning discharge; (d) the lightning discharge proper.

Studies were made particularly to clarify the first three steps. Violent disruption of water drops is a charge-developing process, but quantitative information as to its importance has not been reported, and indirect evidence is that it may play a minor role. Of initial charging processes, that occurring with the collisions of ice or dust particles seems most consistent. Unless initial separation of charge is much greater with ice than with dust, or the concentration of particles is much greater than anything reported, the rate would appear too slow to account for the regeneration of the cloud charge.

Large-scale separation of charge has not been adequately accounted for, but it usually is assumed that gravity and the drag of the vertical wind are principal forces. Another factor, action of the electric field on the charged factors,


FOR "CERTAIN" OPERATION
Anytime... under any condition
Spray was directed into the blade end of the contact housing until more than an inch of ice had accumulated. Then the switch was closed at the speed of motor operation—not slammed. Operation was positive and CERTAIN with no hesitation.
Available
200 TO 3000 AMPERES
7500 TO 287,000 VOLTS

Specify HI-VOLTAGE

the Switch with the ICE-BREAKER CONTACT HOUSING

● The Contact Housing which is standard equipment on all Hi-Voltage Switches, not only protects the contacts, but also helps break any accumulation of ice. Whether the switch is closed or open during the ice formation makes no difference. Operation is positive and "certain." See the illustration above.

This sleet hood is typical of the high degree of craftsmanship which distinguishes every part of a Hi-Voltage Switch . . . a Switch that is built to the same high standards required of all other substation equipment. Other features that contribute to "certain" operation are:

Silver-nickel positive-pressure contacts . . . tested life is beyond 100,000 operations.

Straight push-pull close-open action of switch arm assures most certain opening and closing of switch.

Completely housed operating mechanism with corrosion-proof parts cannot bind or stick. Requires no lubrication . . . never needs adjustment.

Monel ball bearings in stainless steel races, never requiring any lubrication, guarantee that the bearings are ready to operate anytime . . . under any condition.

Completely machined operating shaft adds a definite degree of accuracy and certainty to the switch action.

No field drilling or cutting of parts is required with Hi-Voltage Switches. Their simplicity and ease of installation remove any possibility of improper installation. Time is saved . . . work done at the factory saves hours for the construction crew. After all . . .

IT'S THE INSTALLED COST THAT COUNTS

Recommendations and complete drawings for any installation will be submitted without obligation. Just send a sketch of the substation outline, the proposed location of the switch and the desired location of the operating shaft.

HI-VOLTAGE EQUIPMENT COMPANY

2891 EAST 79TH STREET • CLEVELAND 4, OHIO

Improved Protection Against Overtravel with new Weight-Operated Limit Stop

No. 10-W Youngstown size; 40 H.P.; 230 volts; d.c. maximum rating.

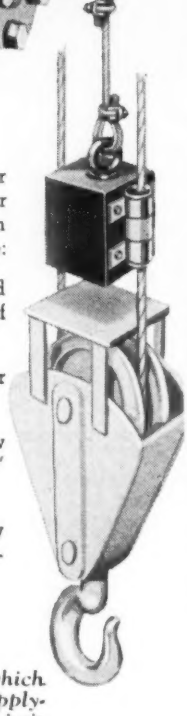
Now, a *weight-operated* Safety Limit Stop for the smaller horsepower crane-hoists. Tripped by *weighted* operating-lever when the danger zone is reached . . . reset *automatically* by suspended *weight* when controller is reversed to lower the hook-block. Other advantages are:

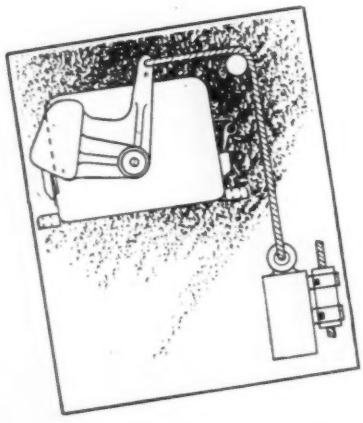
1 No lubrication required—Oilite bearings are self-lubricating and long-lived. This means that the costly and sometimes forgotten item of lubrication-maintenance is eliminated forever.

2 Compact—easy to mount—Small, over-all dimensions—four convenient mounting holes—one suspended weight.

3 Small reset travel—High crane lifts are possible with this new No. 10-W because the amount of travel between "run" and "tripped" positions has been kept at a minimum.

4 High interrupting capacity—Two normally open and two normally closed contacts, mechanically interlocked and with wide, vertical opening, always assure positive interruption of the hoist motor current.





Send for Bulletin 1032 which gives complete details for applying Youngstown Safety Limit Stops to both new and old cranes, either a.c. or d.c.

Optional Style—with offset weighted-arm which eliminates intermediate sheaves when Stop is not mounted directly over crane hook-block. Available on all sizes of EC&M Youngstown Limit Stops.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79th STREET • CLEVELAND 4, OHIO

probably has not been adequately stressed.

More decisive information on the maximum strength of the cloud field is needed, but it may be smaller than hitherto assumed. Initiation of the lightning discharge is another unexplained aspect.

High-Frequency Current For Induction Heating

From a paper by Harold A. Strickland, Jr., (Budd Wheel Co.) before the American Society of Mechanical Engineers, Detroit, June 18, 1946.

POWER for induction heating of metals, which requires relatively high frequencies, is obtained commercially from two basic sources, rotating equipment and oscillatory equipment. By far the largest amount of induction heating power is from motor-driven inductor alternators. High-frequency current is generated in the stator windings by flux ripples set up by a toothed rotor which has no electrical windings or connections.

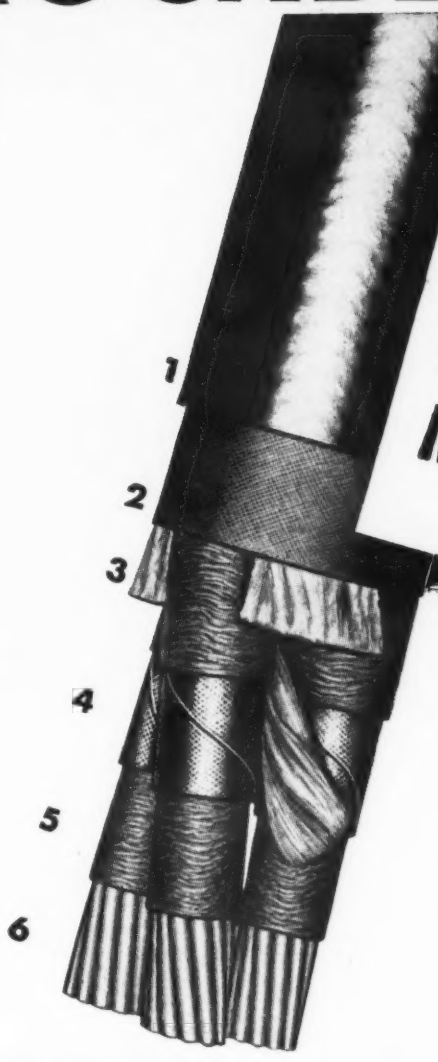
Sets are available in a wide range of ratings and forms, with outputs for 7½ kw. to 1,500 kw. and frequencies from 960 cycles to 10,000 cycles. Larger power ratings and frequencies are being considered and a 20,000-cycle generator has been designed. Voltage is usually 400 to 600, and at the higher value can be distributed economically up to at least 800 ft. Maximum efficiency is about 88.5 percent. Both air cooling and water cooling are used, the latter having slightly higher first cost, but with lower installation costs. In the long run water cooling is the more desirable.

Oscillators for supply of power for induction heating include spark-gap or vacuum-tube oscillators and mercury arc inverters. All of these are higher voltage devices than motor generators. Vacuum-tube oscillators are virtually unlimited as to frequency, although ratings frequently diminish above 1½ megacycles. As most induction heating is done at less than ½ megacycle, this is unimportant. Except for the ability to produce high frequencies, vacuum-tube equipment would be in little demand, for its cost per kilowatt is the highest of all conversion devices and its efficiency among the lowest. Vacuum-tube oscillators are available in outputs from one to several hundred kilowatts.

Spark-gap oscillators are available only in small sizes, cost somewhat less than vacuum-tube oscillators, and commercially are restricted to about 200,000 cycles. The frequency, however, is not produced continuously, as distinct

ROCKBESTOS A.V.C.

Gives Your Plant Complete Protection from Wire-Failures and Cuts Circuit Maintenance in Hot Spots



A PERMANENT ROCKBESTOS CONSTRUCTION THAT ASSURES LONG-LIVED SERVICE

The Rockbestos A.V.C. 600 Volt Power Cable illustrated has each conductor insulated exactly like single conductor Power and Motor Lead Cables (maximum operating temperature 110°C.). Also made with lead sheath or armor and in higher voltages.

1 A tough impregnated asbestos yarn braid, resistant to heat, flame, moisture, oil, grease and fumes.

2 Tape binds jute fillers (asbestos if required) and cabled assembly securely.

3 Heat, flame and moisture resistant impregnated felted asbestos insulation that won't dry out, crack or rot.

4 Asbestos-protected varnished cambric for high dielectric strength and added moisture resistance.

5 Inner wall of impregnated felted asbestos withstands conductor-heating overloads and won't bake brittle or burn.

6 Conductors are perfectly and permanently centered in helically applied non-flowing insulation that provides greater current carrying capacity.

One of 125 different constructions designed by Rockbestos for severe or unusual operating conditions.

Heat ruins most wire insulations. It causes more failures in generating plants than any other trouble-maker. But you can forget this insulation-destroyer if you wire circuits that run too close to boilers, steam lines and hot ash pits with Rockbestos A.V.C. wire and cable.

Besides taking heat without baking out or cracking, *permanently insulated* Rockbestos wires withstand heating and cooling cycles in conduit or duct installations. They won't rot, swell or flow when attacked by oil, grease or corrosive fumes . . . and they give you a high safety factor because they won't burn or support flame.

The answer to this high resistance to destructive elements is in the construction—heavy asbestos braids that resist heat, moisture, oil, grease, fumes and flame; impregnated felted asbestos insulation that takes high ambient temperatures and conductor-heating overloads without baking brittle; and varnished cambric that provides high dielectric strength and added moisture resistance.

Guard circuit operation and reduce maintenance expense with Rockbestos A.V.C. Made in 600 to 5000 volt ratings—including single and multi-conductor power cables, switchboard and lighting wires, control cables and N.E. Code types.

Write for a catalog describing them and various All-Asbestos insulated wires and cables.

ROCKBESTOS PRODUCTS CORP., 156 NICOLL ST., NEW HAVEN 4, CONN.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND CHICAGO
PITTSBURGH ST. LOUIS LOS ANGELES SEATTLE
SAN FRANCISCO PORTLAND, ORE.

BERMICO*
FIBRE CONDUIT

FOR SUREST CABLE PROTECTION---
SPECIFY BERMICO CONDUIT

1 **LIGHT.** Easily handled on the job; one man can carry several 8-foot lengths at once—lay more per working hour.

2 **TIGHT.** All joints are precision milled for tight, speedy, installations.

3 **STRONG.** Bermico Conduit is engineered to take the shocks and stresses of transport . . . the heavy loads imposed during installation.

4 **NO SPLIT COUPLINGS.** With Bermico's specially designed couplings, you end the expense—the loss of time required to replace broken couplings.

5 **WATER PROOF.** Bermico's water absorption factor is extremely low—its insulation factor extremely high, even under toughest conditions.

6 **ACID RESISTANT.** Resistant to soil acids and alkalies, Bermico Conduit is, itself, chemically inert.

7 **SMOOTH INSIDE BORE.** Quick and easy cable "pull throughs"—without danger of abrasions—when you're using Bermico *inspected* conduit!

8 **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.

distributed by
WESTINGHOUSE ELECTRIC SUPPLY COMPANY
Offices in all leading cities

* Reg. Trade Mark

BERMICO FIBRE CONDUIT—A PRODUCT OF BROWN COMPANY

trains of damped waves are generated.

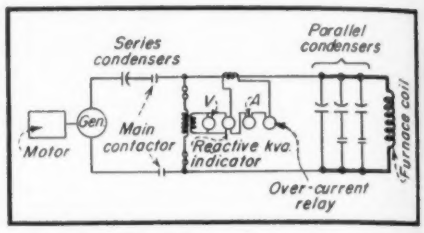
The mercury-arc inverter, newest source of power for induction heating, is available up to 1,000 cycles, which limits its use to through heating of steel of more than 2⅜-in. diameter. Its efficiency is slightly higher than that of the motor generator, and its first cost is about the same.

•

Coreless Induction Furnaces

From a paper by M. J. Marchbanks (Metropolitan Vickers) before the Institution of Electrical Engineers (British).

FREQUENCIES for commercial coreless induction furnaces are of the order of 500 to 2,000 cycles, and come readily within the range of rotating generators. As shown in the diagram, the three main components of the installation are a motor-generator set producing high-frequency, single-phase current at suitable voltage, banks of condensers which keep the generator output at approximately unity power factor, and the furnace itself.



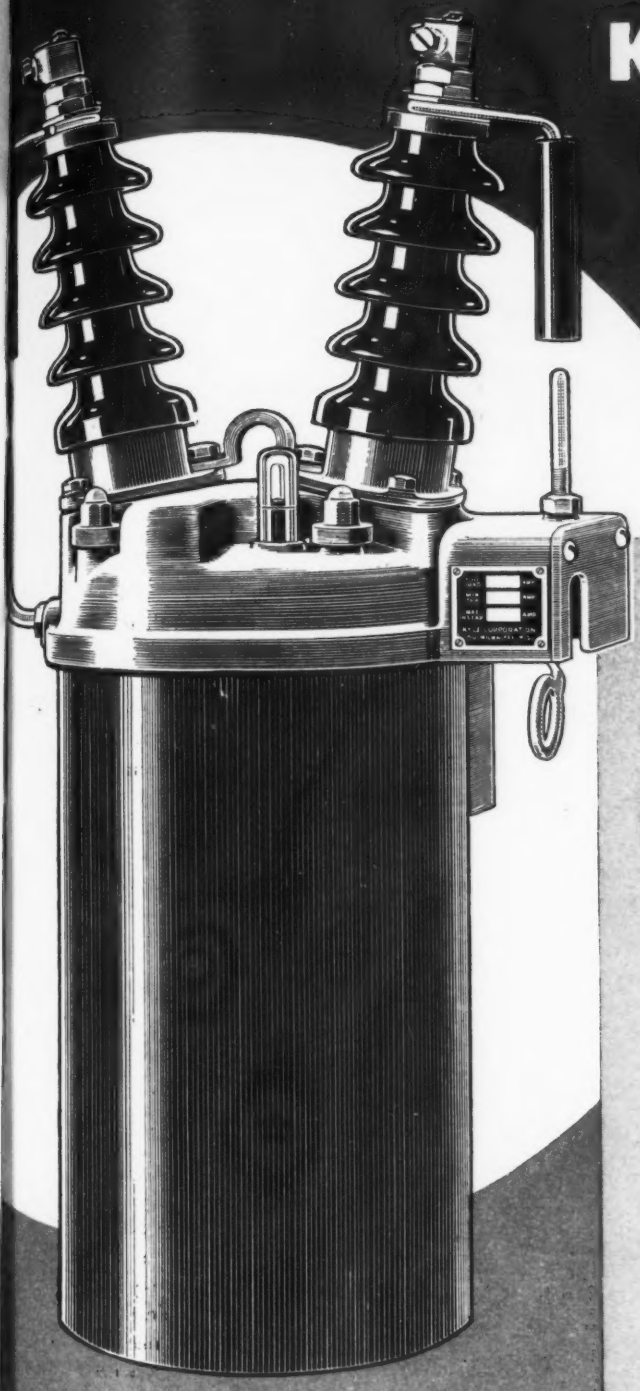
CONNECTIONS of induction furnace equipment (simplified)

In the furnace the refractory melting pot is surrounded by a coil of copper tubing of special section which carries the current and through which flows cooling water. Magnetic shields of laminated iron placed axially around the outside of the coil prevent excessive extraneous eddy-current heating from its stray external field.

Earth leakage protection is necessary if the charge is to be stirred with a metal rod. For the purpose a ground rod is built into the base refractory. Since there is a possibility that the charge may break through the refractory wall and make contact with the energizing coil, a relay circuit is provided which gives indication of impending faults.

Both homopolar and heteropolar inductor generators are used to supply the high-frequency current. At the frequencies used the inherent high reactance is not so serious as in ordinary circuits, since it can be neutralized by a series condenser. The voltage generated is proportional to the difference between a maximum flux and a minimum flux as tooth or slot passes the armature coil.

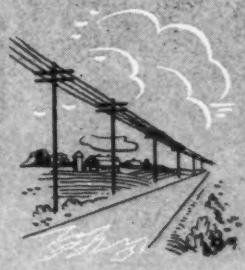
KYLE OIL CIRCUIT RECLOSERS WILL INCREASE YOUR REVENUE



by

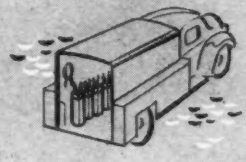
Keeping More of Your Lines in Service

Greater continuity of service on extended rural lines is possible with Kyle Type "H" Oil Circuit Reclosers than is provided by any other economical form of protection. Their use provides instant and automatic clearance of all temporary faults . . . with no interruption in service. Permanent faults are isolated to short branch lines by virtue of the fact that Kyle Reclosers may be coordinated with sectionalizing fuses.



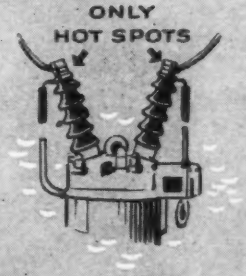
Reducing Maintenance Costs

This automatic elimination of common line faults reduces the number of service trips required. Isolation of branch lines on permanent faults makes for quicker, easier location of line difficulties. Dependable Kyle hydraulic operation . . . without clockwork or motors . . . requires service only at rare intervals. Small, compact, flat-based Kyle Recloser tanks are easily carried in service trucks.



Providing Safe, Trouble-Free Operation

Kyle Reclosers are easy to handle and safe to install and service. Only live parts are the upper terminals on the bushings, providing easy, safe access to the operating handle. This operating handle is trip-free. The Recloser may be manually closed without any danger to the operator. Vibration or jar cannot cause the Recloser to "fall closed" accidentally.



Let your Line Material Representative show you why Kyle Oil Circuit Reclosers are the economical answer to your line protection needs.

Ratings of Kyle Type "H" Oil Circuit Reclosers

Voltage	2400 to 15,000
Ampere Rating	5, 10, 15, 25 or 50
Minimum Tripping Current	10, 20, 30, 50, 100 Amperes
Interrupting Capacity	150, 250, 375, 600, 1200 Amperes

MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

KYLE Circuit Reclosers are Designed and Manufactured for LINE MATERIAL COMPANY MILWAUKEE WISCONSIN

LOAD BUILDING

Panel Heating Installed In Concrete Floors

SOIL-HEATING CABLE or fiberglass-silicone Nichrome wire is placed on concrete base slab and then covered with thin concrete surface to form radiant heating panel in California houses

RADIANT or panel heating installed in concrete floors in residences is one of the West Coast's latest ideas in electric heating of homes. The idea seems to have originated in southern California several years ago when two commercial installations were made by winding iron wire on corrugated paperboard and burying elements so formed in the concrete floor when poured. More recently in the Los Angeles area, No. 19 soil heating cable has been used, again buried in the concrete, this time in concrete floors used in homes. The idea of using concrete floors in homes may sound somewhat revolutionary, but is not without logic where the floor, as in many California houses, is built directly on the ground to start with.

One contractor who started with soil heating cable has now changed to No. 19 fiberglass and silicone insulated resistance wire for twelve homes he is building, and is enthusiastic over possibilities with this method of heating. Eight adobe brick houses at Fullerton also are to have concrete floors to be electrically heated. Another tract of 40 houses at Anaheim will be likewise heated. This means a sufficient number of field installations to provide valuable test results.

Practice in laying the concrete floors is first to place a 3-in. slab of vermiculite concrete on a base of weatherproof-paper-covered rock ballast. The heating element wire is then laid on this slab on 4- to 6-in. centers as shown. Floor surface of concrete, stone or tile, 1 in. thick, completes the floor and provides the wearing surface. Rug pads or full room size rugs, or linoleum in the case of the kitchen, complete the floor for occupancy.

In one of the first installations the No. 19 lead-sheathed soil heating cable was laid in 120-ft. lengths. With approximately half an ohm per foot, this made 900-watt circuits when operated on 240 volts, to give a density of about 20 watts per square foot. Maximum operating temperature of the wire would be 140 deg. F., and would provide a slab temperature of 85 deg. even in zero weather. However, a slab temperature of around 75 deg. is expected to provide full comfort. Temperature control is by Minneapolis Honeywell or General Controls' thermostat. Need for a temperature control responsive to radiant heat has been one of the problems in applying panel electric heating, and so far seems largely unsolved. Temperature lag in the heating panel, whether floor, walls or ceiling, is another problem in radiant heating, about which there is little experience data available.

The enthusiastic builder mentioned calculates the complete electric floor heating installation for a house of 3,600 sq.ft. would cost less than $1,000, as compared with $2,600 for a gas furnace job complete, and $5,200 for a gas or oil-fired hot water system. Many other means of applying radiant electric heating are being tested and experimented with on the West Coast, and out of field experience should come some valuable data that may lead to widespread use of this means of obtaining comfort, with kilowatt-hour consumption claimed by some to be 30 percent to one-third less than by convection heating.

•

Adequate Wiring Pays Its Own Way

EVIDENCE that adequate wiring does increase energy sale and revenue and does make them grow more rapidly than when wiring is not adequate, comes from an analysis made by the Kansas City Power & Light Co. and summarized in the accompanying table. The study covers 210 homes costing $3,000 and more, built in

BUILD BETTER PERFORMANCE INTO ELECTRONIC TUBES WITH

Driver-Harris RADIO ALLOYS

For continued success no industry depends more on quality, precision and constancy of metals used, than radio. Small parts perform important functions and if not made of proper alloys that conform to rigid specifications the entire product is affected. Particularly is this true in the manufacture and development of Cathode-Ray Tubes.

Since the inception of radio Driver-Harris metallurgists have pioneered in developing and manufacturing special purpose alloys for this field. Today the leading manufacturers of Cathode-Ray Tubes use D-H alloys to help develop longer life and clearer images.

Driver-Harris makes alloys for every electronic tube requirement—for filaments, grids, plates, grid side rods, glass seals, cathode sleeves, socket prongs, filament support springs and mica straps. In addition there are over 80 other electrical *heat and corrosion-resistant* D-H alloys available for various electronic applications.

If the alloy you need hasn't already been developed tell us about it. Our engineers with 46 years experience are at your service.

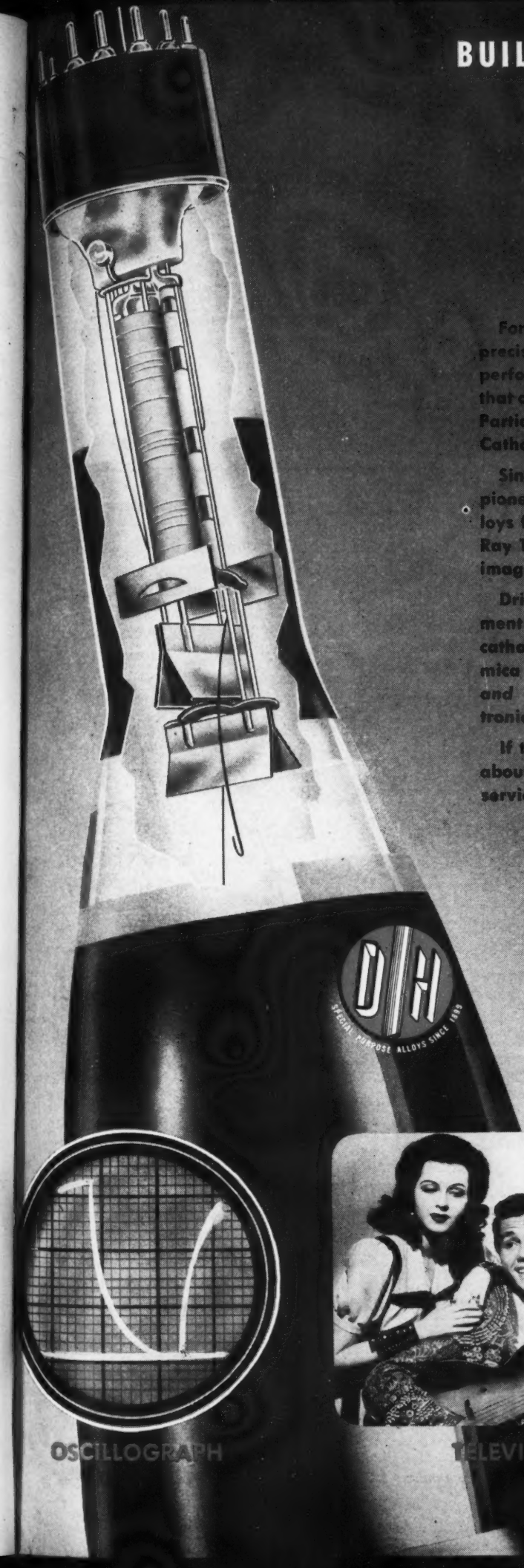
Famous D-H Radio Alloys:
NICHROME • GRIDNIC* • NICKEL "A", "D", "E", "Z" • FILNIC* 14 ALLOY • 42 ALLOY • 52 ALLOY • NILVAR**

Driver-Harris COMPANY

Exclusive Manufacturers of Nichrome

HARRISON, N. J.

BRANCHES: Chicago • Cleveland • Detroit • Los Angeles San Francisco • Seattle



OSCILLOGRAPH

TELEVISION

RADAR

*Trade Mark Reg. U. S. Pat. Off.

WITH TIREX WELDING CABLES

The outstanding flexibility of TIREX Welding Cables so greatly reduces wrist and body strain that welders are able to do faster, more efficient jobs with less actual work on their part.

TIREX flexibility is the result of stranding together the thousands of threadlike copper wires that make up the conductor, and it is assurance that your welding cable will not hamper the welder or his operations by knotting or kinking.

For higher value when you next buy, order Simplex-TIREX, the only welding cable protected by the tough, flame-resisting Selenium Neoprene Armor.

WELDING CABLE

Size A.W.G.	Strands	Gross lbs. per 1000 ft.	Outside Diam. - Inches
4	1078	265	.495
3	1372	290	.500
2	1715	350	.560
1	2156	445	.625
1/0	2695	525	.675
2/0	3381	635	.750
3/0	4263	765	.815
4/0	5341	945	.900

Other sizes available from #8 to 1,000,000 C.M.

Simplex-WIRES & CABLES

SIMPLEX WIRE & CABLE CO. 79 SIDNEY ST. CAMBRIDGE 39, MASS.

Kw.-Hr. Sales To, and Revenue From, Adequately and Inadequately Wired Homes

	RED SEAL	NON RED SEAL
Kw.-Hr. per customer—1941	1,482	1,261
Kw.-Hr. per customer—1945	1,897	1,589
4-year Increase	415	328
Percent Increase	28	26
Revenue per Customer—1941	$53.25	$46.42
Revenue per Customer—1945	$64.62	$55.94
4-year Increase	11.37	9.52
Percent Increase	21.4	20.5
Number of Homes	137	73
Average Room Count	5.8	5.3
Percent of Homes with		
Electric Ranges	24.8	27.4
Gas Rangers	74.5	72.6
Electric Refrigerators	91.2	93.2
Gas Refrigerators	8.8	6.8
Electric Water Heaters	1.6	...
Gas Water Heaters	98.4	100
Outlets per Home	64	54
Additional Outlets in Red Seal Home	10	
Revenue per Additional Outlet—1941	$0.683	
Revenue per Additional Outlet—1945	$0.868	

1940. The Red Seal homes average a slightly bigger room count, but against this is the fact that the others have somewhat greater proportions of electric ranges and refrigerators, making a pretty even basis of comparison. The figures of revenue per additional outlet at the bottom of the table sum up the whole story; they indicate that promotion of adequate wiring is a profitable utility activity.

•

Load Building Promotion Plan

WILLIAM A. ROONEY

Union Electric Co. of Missouri
St. Louis

THE CONSTRUCTION of a complete 4½-room "Electrical Living" house on the first floor showroom of their main office has been announced by Union Electric Co. of Missouri. St. Louis, as the keystone of their fall and winter electrical living promotion.

The house, which is to be ready for public inspection October 1, will include living room-dinette, bedroom, kitchen, bath, and utility room. All rooms will be furnished with latest model electric appliances. Provision is made for the house to be an example of adequate wiring. Plumbing connections will be included in the home construction so that garbage disposer, dishwasher, water heater, and laundry equipment can be demonstrated.

Supplementing the complete home will be four life-size. fully equipped kitchens showing different style arrangements, a display of seven minia-

CHANCE (TIPS) HOT TAP CLAMPS

hold tight without sticking -

PERMA-GRIP TAP CLAMPS . . .

Make permanent or temporary hot tap connections that are dependable and economical. They stay put without vibrating loose, and yet they can be removed or replaced at any time because operation of the eye screw is unaffected by corrosion and can be readily unscrewed with a Clamp Stick. They are made for tapping to aluminum, copper, or steel conductors and are available in a complete range of sizes to meet all requirements.

- HIGH CURRENT CAPACITY
- HIGH MECHANICAL STRENGTH
- HOLD TIGHT WITHOUT STICKING
- THREE POINT CONTACT
- POSITIVE PRESSURE JUMPER CONNECTION
- AVAILABLE IN ALL TYPES AND SIZES

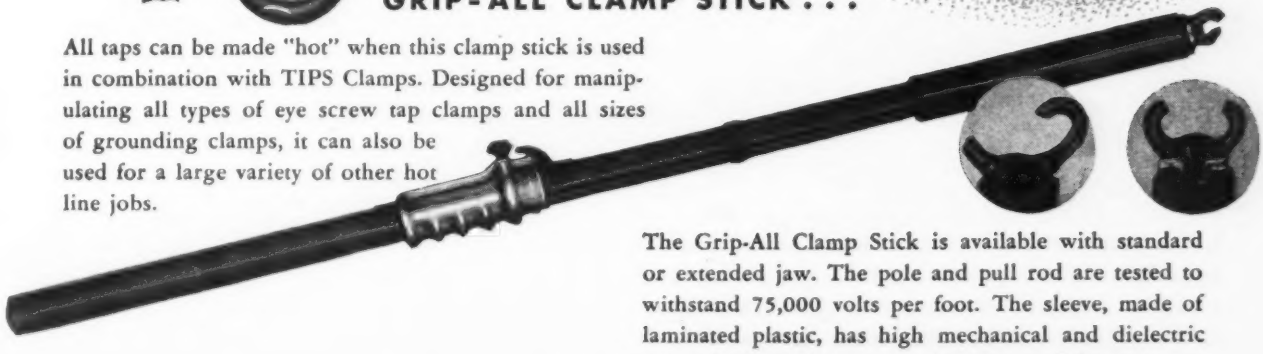
SNAP TAP CLAMPS . . .

Provide both a strong, permanent connection and a rapid "disconnect." The Snap Tap Clamp is applied to the line with a quick snap effect, using any Chance Clamp Stick, and is tightened by turning the eye screw. Available for all types of connections. The jaws of the Snap Tap Clamp will take conductors ranging in size from No. 8 solid copper to 4/0 stranded copper.

Duck bill, compression tap wire terminal, and enclosed thread eye screw are made of high strength bronze.

GRIP-ALL CLAMP STICK . . .

All taps can be made "hot" when this clamp stick is used in combination with TIPS Clamps. Designed for manipulating all types of eye screw tap clamps and all sizes of grounding clamps, it can also be used for a large variety of other hot line jobs.



The Grip-All Clamp Stick is available with standard or extended jaw. The pole and pull rod are tested to withstand 75,000 volts per foot. The sleeve, made of laminated plastic, has high mechanical and dielectric strength. Metal fittings are aluminum and bronze.

Write for detailed information about these indispensable maintenance tools

C4611

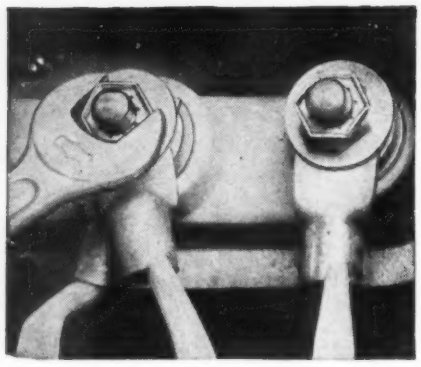
"THERE'S NOTHING TOO GOOD WHERE LIFE IS AT STAKE"

ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

PALNUTS Keep Terminal connections Permanently Tight



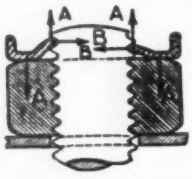
- *Perfect Conductivity*
- *No heating or corroding of contact surfaces*
- *Easy, speedy assembly*

Palnuts apply on TOP of the regular nuts, holding them to original tightness. Spring washers are eliminated between nut and terminal lug. There can be no backing off of nuts, nor opened spring washers to reduce contact. Instead, full conductivity of the entire nut seat is maintained under severest vibration.

Double-locking Palnuts are single thread locknuts, made of tempered spring steel or Duronze. They are easily, quickly spun on with the fingers and locked with 1/3 turn of a wrench. Require only 3 bolt threads space, are light in weight, low in cost, may be re-used.

Palnuts are available from stock for every utility requirement. Write for Palnut Manual giving engineering data.

Double Locking Action



Arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.

THE PALNUT COMPANY

51 Cordier St., Irvington 11, N. J.

ture kitchens, a room where homemakers can talk over their kitchen plans with company home economists. Coordinated displays will be erected in the company's 25 branch stores in the area.

Plans call for industry-wide participation, with representative equipment from all major appliance manufacturers distributing in the St. Louis area to be shown at some time during the display period.

Initial announcement to the trade was made August 6 at a meeting of distibutors. A cooperative program is to be announced and final plans for a dealer-public tie-in contest presented to dealers at a meeting scheduled for September.

Promotion efforts to back up the home show include a September-October showing of 136 billboards, 2,110 street car cards, 20,000 lines of newspaper advertising (4,000 rotogravure), 225 spot announcements, plus dealer promotional material.

To round out the fall activity, the utility has announced separate campaigns on lighting for September, another on ranges during November, and a "Resolve To Live Electrically in 1947" campaign during December. Radio plugs on electric blankets and portable heaters are scheduled for cold snaps.

All manufacturers are being invited to participate in this activity through their distributors.

•

Battery Plates Dried With Infrared Lamps

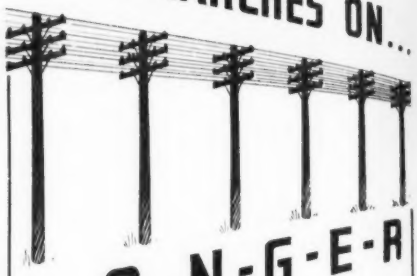
EDWARD JIRIK and A. J. McILWRAITH*

Electricity Sales Department
Commonwealth Edison Co.
Chicago, Ill.

CONVERSION of an open-flame oven to electric operation with infrared radiant heat has resulted in quicker drying and less handling in the processing of battery plates at the Franklin Storage Battery Co., Chicago. Formerly, only partial drying was accomplished by the existing gas oven and an additional 24-hr. rack drying period was necessary. Now with 22½ kw. of reflector heat lamps installed, complete moisture removal is achieved in approximately 20 minutes

* Winners of company's 1945 Sales-Engineering Award.

TIME MARCHES ON...



L-O-N-G-E-R

for Poles treated with

PERMATOX "A"

(5% Pentachlorphenol in petroleum solvents)

EXTRA YEARS of enduring, low-cost service are assured for poles and crossarms protected with PERMATOX "A".

This clean, effective and economical preservative treatment controls decay, shell-rot and termite attack.

Pressure-treating or vat-soaking new poles insures a maximum "life span" at reduced maintenance rates.

Reclaim old poles by cropping off decayed tops and butts, shaving away all rotted portions, and spraying or brushing with PERMATOX "A".

Economical method of treating full length poles in dipping vat of PERMATOX "A" Solution.

**Furnished in Two Forms:*

DOWICIDE 7
Pentachlorphenol* crystals

PERMATOX "A"
5% Pentachlorphenol* in suitable petroleum solvents

* Manufactured by The Dow Chemical Company

Write for Bulletin—Dept. E

CHAPMAN CHEMICAL COMPANY
Formerly A. D. Chapman & Company, Inc.
333 N. Michigan Ave., Dept. E
Chicago 1, Ill.

Charlotte, Chicago, New York, New Orleans, Los Angeles, Portland, Memphis, Houston

striking the might from termite!

How Dowicides Forestall Destruction

Public utilities, like other efficient industries, have learned they can depend on Dowicides to keep termites and decay from eating into the profit column!

Perhaps no other enterprise must combat the enemies of wood under such adverse conditions. Wood poles, carrying communication and power lines through every kind of climate, are preyed upon by mold, decay and termites.

Maximum protection for poles (or for wood in any form) is assured by using Dowicide 7 (Pentachlorphenol). Applied at low concentrations in light fuel oil, pentachlorphenol penetrates better than higher viscosity preservatives, gives better protection than water-soluble materials. Pentachlorphenol is only slightly soluble in water and low in vapor pressure. These factors conserve its extremely high toxicity for unsurpassed effectiveness.

Choose Dowicides! Stop avoidable losses in your industry today!

DOWICIDE

germicides and fungicides

control termites mold and bacteria

DOWICIDES IN THE ELECTRICAL INDUSTRY

Effective preservative treatment of wood poles and cross arms is attainable with Dowicide 7 (Pentachlorphenol). Impregnation is achieved by heating the wood, followed by a cold bath in a pentachlorphenol solution. Dowicides also protect cotton braid covering and jute roving from dry rot and mold in overhead and underground cable installations.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

EASIER TO APPLY TO HOT OR DEAD LINES . . .

No. 1628-3BH Grip—maximum opening of .44", safe load 4500 lbs., weight 3¼ lbs. No. 1628-5BH Grip—maximum opening .58", safe load 8000 lbs., weight 6¼ lbs.

. . . the KLEIN-made CHICAGO GRIP!

A copy of the CHICAGO GRIPS Folder, Bulletin No. 3141, will be sent on request.

Here's a grip that's ideal for hot or dead lines. Slip a lift stick through the eye of the safety latch—the weight of the grip opens the jaws and perfect balance holds the grip horizontal. It may be slipped onto any wire in perfect safety. The safety latch also makes it possible to apply the grip close to the pole and to slide it out any desired distance—it can't fall off.

Lever action of Chicago Grips gives maximum efficiency—the harder the pull the tighter the hold. Forged parts are alloy steel, heat treated; jaws are lined with bronze. Order now—your supplier will ship your order as soon as possible.

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

KLEIN TOOLS EST. 1857

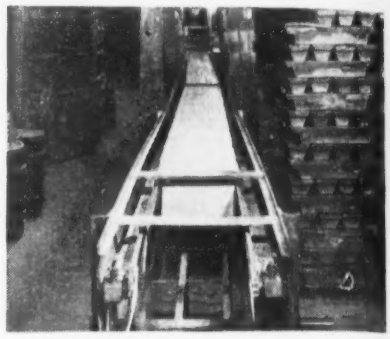
SINCE 1857

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

and rack drying has been eliminated.

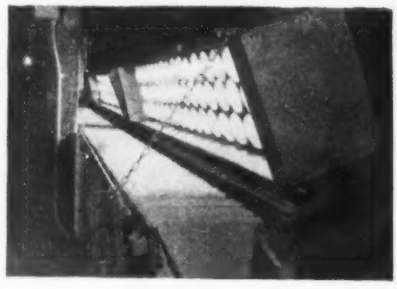
The original gas oven was 1 ft. wide, 3 ft. high and 30 ft. long. Burners were two 15-ft. rows of perforated pipe three inches apart below a chain-belt conveyor that runs the length of the oven.

Battery plates impregnated with a paste of red-lead oxide, sulphuric acid and water emerged from a "paster" onto the conveyor and passed at the rate of a foot a minute over the open flame for the first 15 ft. of the 30-ft. conveyor. The remaining 15 ft. were practically heat free because the chemical reaction and gas fumes were unbearable to employees.



GAS-FIRED OVEN — Storage battery plates were partially dried (above) by passage over open-flame gas burners along this 30-ft. conveyor. Supplementary rack drying at room temperature was required to remove final moisture traces

RADIANT DRYING — Ninety 250-watt reflector heat lamps in two 10-ft. bonnets (below) now dry the storage battery plates thoroughly in about 20 minutes, eliminating the rack drying period completely



Since the plates were not completely dry as they came off the conveyor, they were formerly placed in a drying room for 24 hours at room temperature before being removed for further processing. The plates must be completely moisture free. If not, the remaining moisture will cause bubbling and breaking during charging, preparatory to being placed in the battery shell.

We thrive on the TOUGH ONES!

HE generally comes alone to see you. You called for him because something's gone wrong with a machine or process . . .

Now you tell him about it, and it turns out he knows a lot about equipment just like yours. Nine chances out of ten he can tell you right off what to do. You feel better right away.

And the tenth chance? Well, that's the tough nut. Our man goes away . . . and comes back double! Yes, he brings another man who may be a chemist . . . or a former machine designer . . . or a former shop superintendent . . . but definitely a specialist. These two men between them can almost always fix your tough nut problem.

But how about that one problem that stumps both men? Now you get something special! The research laboratory enters the picture . . . a new formula is developed . . . the refinery produces a trial lot . . . and you receive a sample.

You try the new stuff—*and it's O. K.!* Then you tell your Boss: "Sure was a headache, but here's how I licked it . . ."

And you did! Didn't *you* think of calling the Shell Lubrication Engineer?

* * *

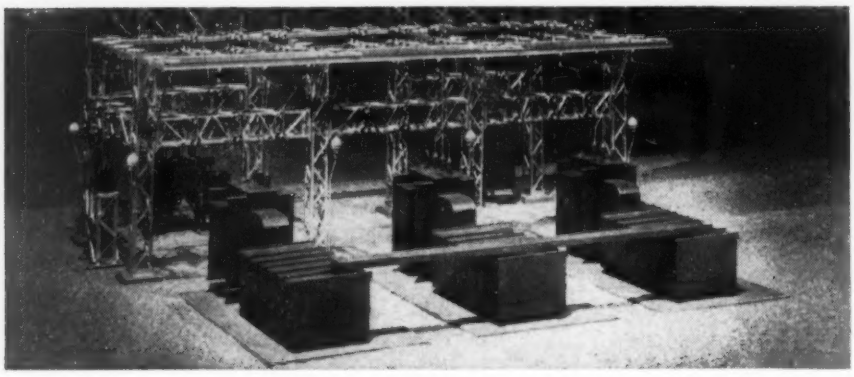
Call your local Shell Representative, or write Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL INDUSTRIAL LUBRICANTS

SHELL

NEW EQUIPMENT

"Package Substations" Developed Up to 45,000 Kva.



A FAMILY of "Package Substations," incorporating as a coordinated, ready-to-assemble unit the elements and components which together comprise the completed installation, have been announced by the General Electric Co., Schenectady 5, N. Y. They are available in any one of hundreds of arrangements in ratings up to 45,000 kva., and utilize standard transforming, regulating, relaying, metering and protective equipment.

At the present time, substation designs from 750- to 4,500-kva. capacity, 11- to 69-kv. incoming and 2.4- to 13.8-outgoing voltage have been approved. In addition to the factory assembled unit, the unit substation includes steel structure, lightning arresters; high-voltage metering and relaying instrument transformers; outdoor oil circuit breakers (or fuses); disconnecting switches; station lighting; relaying as required (carrier, pilot wire, power directional, distance, differential, overload, and reclosing); and control cables.

Under the program the various parts of packaged substations are shipped to the installation site in preassembled sections as large as transportation and handling facilities will permit on a coordinated time schedule.

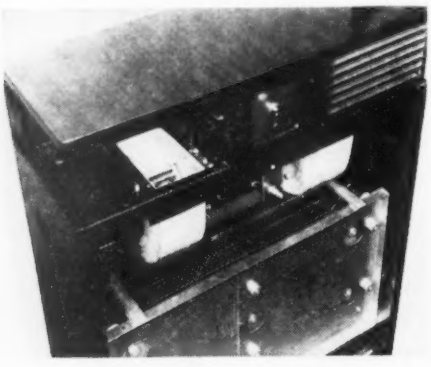
The company reports the units have a high degree of flexibility which allows for future load changes.

•

Precipitator Designed For Domestic Use

AN ELECTROSTATIC precipitator for removing airborne particles such as dust, pollen, smoke, etc., has been announced by Raytheon Mfg. Co., 60 E. 42nd St., New York 17, N. Y.

The unit, which is designed for domestic use, operates on 110-volt, 60-cycle current and has a 100-watt demand. It is housed in a 39x26x9-in. cabinet and it is available in grain mahogany, walnut and ivory finish.



It may be connected to draw in outside air and is controlled completely by single "on-off" switch which is mounted on front panel above the collector cell.

•

Thermoplastic Insulated Wire Available Up to No. 14

A THERMOPLASTIC insulated radio hook-up wire, called Intelin Hook-Up wire, has been announced by Federal Telephone & Radio Corp., Newark, N. J. The wire is available in 14 colors for ease in assembly and service, is reported as easy stripping, small in outside diameter and having good flexibility qualities.

The insulation is stated to be flame resistant and abrasion resistant. It is also reported to remain operative under extreme humidity conditions, to be unaffected by oxidation and changes in temperature and not to crack or become brittle.

Short time tests show a dielectric strength of 800 volts per mil with a 0.020-in. wall thickness; 30-day tests at 90 deg. C. reveal a tensile strength of 2,100 to 2,250 psi. The wire is available in solid or stranded types ranging in size from No. 24 to No. 14 and is suitable for use in appliances and communication equipment as well as radio and electronic equipment.

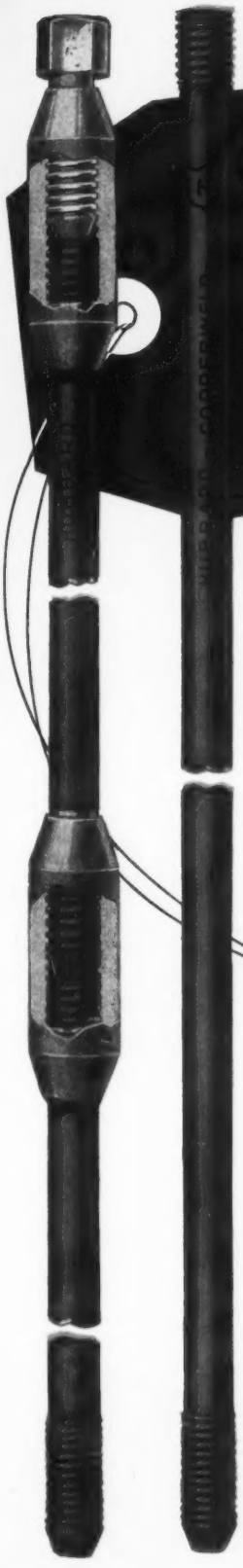
•

Low-Speed Tachometer Indicator Down to 1 Rpm.

A LOW-SPEED switchboard tachometer, which indicates as low as 1 rpm. or ¼ ft. per minute, has been announced by Metron Instrument Co., 432 Lincoln St., Denver, Colo. The device consists of a tachometer head and an indicator or recorder which may be mounted any distance from the head.

While electric in nature, the tachometer is not a generator nor an electronic device. The head is a contact-making mechanism which is connected in series with a reactance and the indicator to a voltage source, so that the current flowing through the indicator is directly proportional to the speed.

Operating power is obtained from a 110-volt, 60-cycle circuit and calibra-



The Endurance of Copper-Plus The Strength of Steel

HUBBARD-COPPERWELD SECTIONAL GROUND RODS

Hubbard-Copperweld Sectional Ground Rods have been designed for use in locations where deep grounds are necessary to reach firm soil. The use of sectional rods eliminates the nuisance of extra long rods which are clumsy to handle in the warehouse and on the truck. Sectional rods are the same as standard except that they are threaded on each end. Joining is accomplished by couplings as shown. For driving purposes a stud bolt is inserted in the coupling at the top of each section.

Assembly of Sectional Rods—Couplings and Stud

Stock No.	Description	Size	Approx. Wt. per 100 Pcs.
29430	Sectional Rod	1/2" x 10 Ft.	550
29440	Sectional Rod	5/8" x 10 Ft.	860
29450	Sectional Rod	3/4" x 10 Ft.	1220
9533	Coupling	1/2"	18
9534	Coupling	5/8"	30
9535	Coupling	3/4"	46
29533	Stud	1/2"	15
29534	Stud	5/8"	23
29535	Stud	3/4"	35
9491	Safety Set Screw Ground Clamps	1/2"	25
9492		5/8"	35
9493		3/4"	45
9591	Sq. Head. Set Screw Ground Clamps	1/2"	25
9592		5/8"	35
9593		3/4"	45

HUBBARD AND COMPANY

PITTSBURGH · CHICAGO · OAKLAND, CALIF.

EXCLUSIVE NATIONAL SALES AGENTS FOR COPPERWELD GROUND RODS AND CLAMPS

BLACKBURN CONNECTORS

BLACKBURN Hi-Strength CONNECTORS are strong, durable and lasting. In fact, they're the *most durable* connectors you can buy! That's because they're made of DURONZE, which is 75% stronger than hard copper or commercial bronze. And they have a reinforced pressure bar, for still greater strength.

Once installed, BLACKBURN CONNECTORS are there to stay—indefinitely. This is an important factor in these days of mounting labor costs. Now, as never before, *it pays to use a QUALITY Connector.*

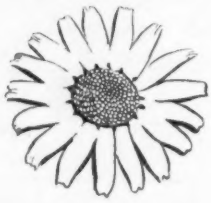
BLACKBURN *Hi-Strength* CONNECTORS

Over 100 Conveniently-Located Jobbers' Stocks

JASPER BLACKBURN PRODUCTS CORP.
First, Madison & Clinton Sts. • St. Louis 6, Mo.

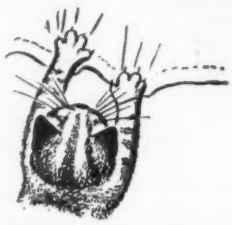
BUILDERS OF QUALITY CONNECTORS FOR OVER 10 YEARS

IT'S FRESH AS A DAISY...



CELLOPHANE-SEALED — then individually boxed—every roll of Jenkins Gold Seal Friction Tape is bound to reach you factory-fresh!

WON'T RAVEL OR PEEL...



IT WON'T smudge hands either... and it won't dry out on the shelf or job, thanks to quality control of fibre and friction compound.

IT STICKS LIKE A LEECH . . .

HOT weather or cold, Gold Seal Friction Tape always has the right amount of Tack ... always sticks to the job — but never to the hands!

. . IT'S JENKINS GOLD SEAL!

MADE BY the makers of Jenkins Diamond Seal Friction and Rubber Tapes — both of which meet ASTM and Federal specifications.

JENKINS *Gold Seal Tapes*

Jenkins Bros., Rubber Div., 80 White St., New York 13, N. Y.

FRICTION . . . RUBBER

tion is reported unaffected by line voltage changes. The manufacturer reports a sustained accuracy of 1 percent and that accidental overspeeds do not damage the unit. Multiple ranges and multiple head units are available for the device, which is reported particularly useful in measuring extrusion speeds in metal processing mills.

TECHNICAL LITERATURE

Porcelain—A new booklet on electrical porcelain, its history, uses and adaptability for different types of insulation is available from National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y. It was written by John C. Lebens, Jr., with the cooperation of 13 electrical porcelain manufacturers. The appendix contains a technical discussion of the electrical properties of porcelain.

Turbo-Generators — "Preferred Standards for Large 3,600-RPM., 3-Phase, 60-Cycle Condensing Steam Turbine-Generators" (A.I.E.E. Nos. 601 and 602) is now available from American Institute of Electrical Engineers and American Institute of Mechanical Engineers, 29 West 39th St., New York 18, N. Y., for 30 cents per copy. The significant features in the new standards are: (1) six standard unit ratings from 11,500 to 60,000 kw. inclusive; (2) one or two standard values of throttle pressure and temperature for each rating; (3) definite number of extraction openings for each machine, with specified values of saturation temperature at each opening when operating at turbine-generator rating with full extraction from all openings; and (4) specification that the guaranteed turbine capacity, in kilowatt output at the generator terminals, shall be 10 percent above the turbine-generator rating of each unit instead of 25 percent margin usually provided in the past.

Circuit Breakers—"American Standards for A.C. Power Circuit Breakers" (C37.4 through C37.9) is available from American Standards Association, 70 East 45th St., New York 17, N. Y., at $1.25 per copy. It also contains (1) Methods for Determining the Rms. Value of a sinusoidal Current Wave and a Normal-Frequent Recovery Voltage, (2) Schedule of Preferred Ratings, (3) Operating Duty for Standard and Reclosing Service, (4) Rated Control Voltages, and (5) Test Code for Power Circuit Breakers.

School Lighting—"Lighting for Shops and Special Classes," a 42-page teachers manual, is available from the National Education Association, 1201 Sixteenth St., Washington, D. C., at 10 cents per copy. Explains the quantity and quality of light needed in class rooms where office tasks, woodworking, machine and electrical operations, welding, forging, car repairing, dressmaking, restaurant management, beauty services, etc., are taught. Also contains a section devoted to lighting maintenance and another on classroom wiring.

Machine Testing—"Test Code for Synchronous Machines," A.I.E.E. No. 503, containing instruction for conducting the more generally applicable and acceptable tests to determine the performance characteristics of synchronous machines, is available from the American Institute of Electrical Engineers, 33 West 39th St., New York, N. Y. It covers synchronous generators, motors (larger than fractional horsepower), condensers, frequency changers, and rotary phase advancers.

Because it helps improve both design and performance, more and more engineers are specifying—more and more manufacturers are using—more and more buyers are demanding Fiberglas Electrical Insulation in many types of electrical, electronic, video and radio equipment.

There is a type of Fiberglas Electrical Insulation to meet virtually every insulation need. And this insulation not only offers mechanical and electrical advantages, but competitive sales advantages as well.

National and technical publication and direct mail advertising are stimulating the demand for Fiberglas-insulated electrical equipment.

You, too, can benefit from *all* of the advantages of Fiberglas Electrical Insulation—capitalize on the growing preference and demand. Ask to see the new book "The Swing to Fiberglas"—or write for catalog EL 44-7. Owens-Corning Fiberglas Corp., Dept. 858, Toledo 1, Ohio. Branches in principal cities.

In Canada, Fiberglas Canada Ltd., Toronto, Ontario

OWENS-CORNING
FIBERGLAS
TM. REG. U.S. PAT. OFF.

Fiberglas is the trade name for these electrical insulation materials and many other products made from fine, strong, pliable, moisture and heat-resistant ageless glass fibers.

NEWS ABOUT PEOPLE

Central Maine Power Names D. M. Libby Rate Engineer

Donald M. Libby has been appointed rate engineer of the Central Maine Power Co., and will coordinate rate applications throughout the system besides being responsible for investigations of new rates.

Mr. Libby joined the then Cumberland County Power & Light Co., Portland, in 1922 and was active in power sales engineering for a considerable period. He served in the U. S. Army for five years, three of which were spent in North Africa and Italy as supply and evacuation officer of the Ninth Infantry Division; chief of the civil supply branch of the G-4 Division, Allied Force Headquarters, and general purchasing agent for the U. S. Army in the Mediterranean. He held the rank of colonel when recently discharged.

D. M. LIBBY

Returning to Central Maine Power, he served as assistant safety director until his recent appointment. Mr. Libby's headquarters will be at Portland for the present.

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▶ GEORGE L. ROSENBERGER, electrical engineer with the Virginia Electric & Power Co., Richmond, has retired, bringing to a close a career of more than 30 years in the electrical development of northern Virginia. Mr. Rosenberger had been with Virginia Electric & Power and predecessor companies since 1924. He was superintendent of public utilities for Manassas from 1914 to 1920, and for two years thereafter, was superintendent of the Herndon Light & Supply Co. In 1922, as general superintendent of the Fairfax and Loudon Light & Power Co., he built the first transmission line between Alexandria and Leesburg, opening up to rural electrification one of the state's richer farming regions. Mr. Rosenberger is a member of the A.I.E.E.

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New Appointments Made by Boston Edison Co.

Dale E. Washburn, formerly electric and steam sales manager, Boston Edison Co., has been appointed assistant to the director, electric and steam sales organization. S. Murray Jones, executive assistant to Mr. Washburn and head of the company's technical service division, succeeds Mr. Washburn in his recent position. Paul E. Simpson has been appointed executive assistant to Mr. Jones in his new position, and C. Everett Kinchla has become head of the records and rate service division. Elmer W. L. Davis has been named assistant to the rate engineer, and Harry J. Baker has been appointed special statistician, heading a division of the rates and statistics department. Herbert R. Sanford has been made head of the general purchasing division, general purchasing department. Sumner R. Keyes continues as general purchasing agent.

•

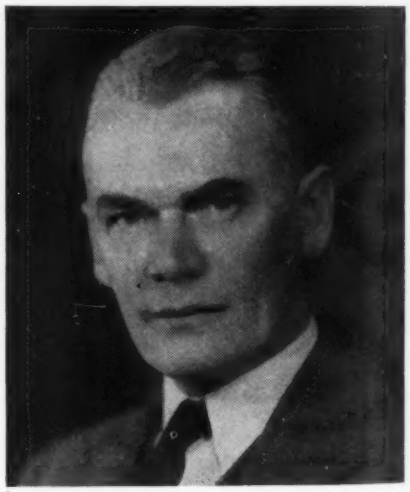
▶ J. H. VIVIAN, formerly protection engineer, Southern California Edison Co., Los Angeles, has been appointed electrical and maintenance engineer for the company.

▶ JAMES B. COOK, who has been associated with the Cincinnati Gas & Electric Co. for 24 years, has been given charge of the structural section of the general engineering department to succeed C. RUSSELL DOLE, resigned. During his association with the company, Mr. Cook handled the structural design for many major projects. Mr. Dole relinquished his duties with the Cincinnati utility after an association of 19 years to join the Dayton Power & Light Co.

General Electric Promotes C. M. Lynge; Clark Retires

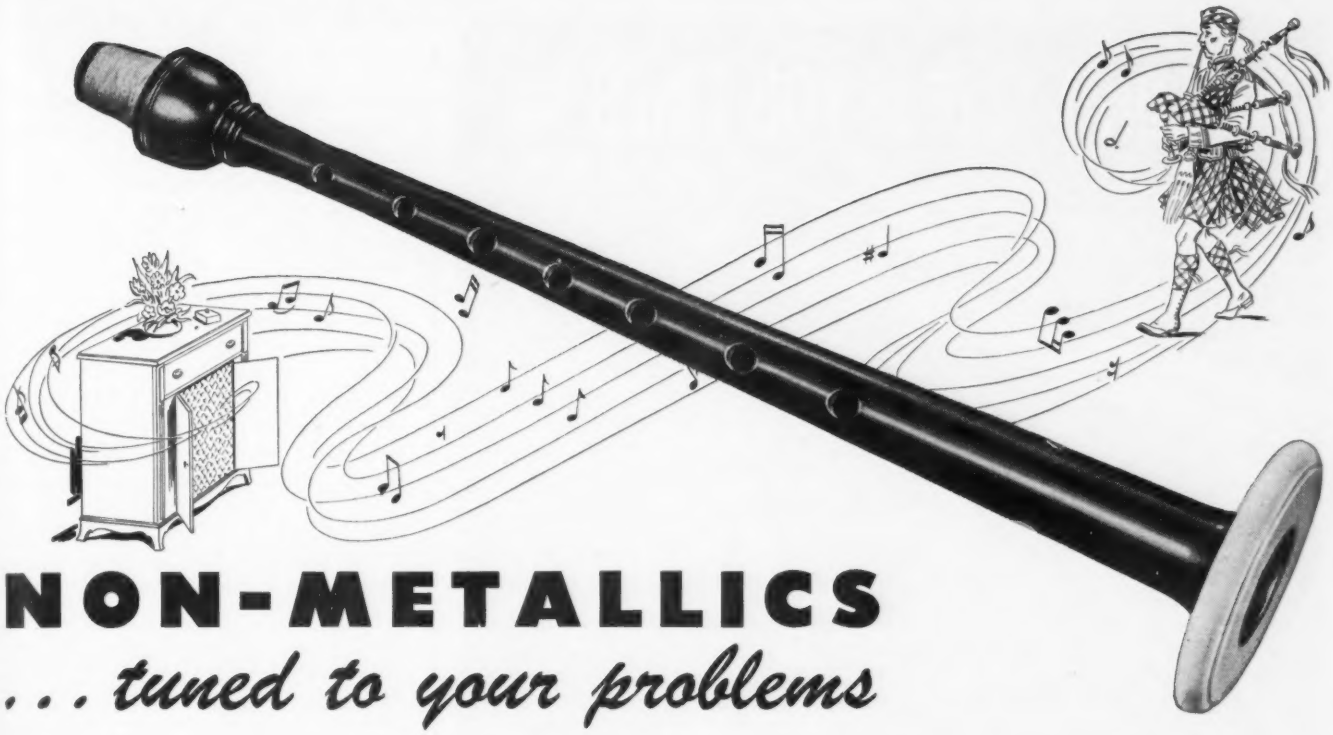
Retirement of W. Stewart Clark as manager of manufacturing for the General Electric Co.'s appliance and merchandise department and the appointment of Carl M. Lynge, general works manager of the G.E. Bridgeport plant, to succeed him, have been announced.

Mr. Clark's retirement rounded out 47 years of active service with the company, 26 of which were spent as executive head of the Bridgeport Works. Mr. Lynge, who had already assumed part of Mr. Clark's duties in January of this year when the latter relinquished the position of Bridgeport Works manager, will take over the complete responsibility for general manufacturing activities in all the A & M department's plants. He will also continue as manufacturing operations head of the Bridgeport Works and all branch plants.



C. M. LYNGE

Mr. Lynge joined the test course in Schenectady and Pittsfield in 1912 and during the next seven years he was a design engineer on large electrical apparatus, worked in the company's cost and production departments, and finally headed up motor manufacture in Pittsfield. Transferring to Bridgeport in 1920 when General Electric established operations there, he served in various capacities and in 1929 was made assistant works manager, assuming the additional title of assistant manager of manufacturing for the appliance and merchandise department in 1945. Ex-



NON-METALLICS

... tuned to your problems

WHETHER you play the bagpipe or the radio . . . you want the music to sound natural . . . so do your customers. Your product must be able to compete for their ears, eyes and pocketbook.

C-D NON-metallics can help you attain those ends. C-D NON-metallics are engineered to meet specific design, production and performance problems, involving mechanical and electrical insulating properties.

The bagpipe valve-stopped tube illustrated is an excellent example of a C-D product designed to meet specific production and performance problems. It is made of Black Grade XX molded DILECTO tubing. In addition to the machining plainly visible, the inside diameter of the tube has three distinctly different stepped tapers. The tube must of course retain its dimensions in spite of moisture conditions.

The ease with which C-D Dilecto can be machined, its dimensional stability combined with its good electrical insulating properties, its light weight and its great strength make it a material that may be the answer to one or more of your "What Material?" problems.

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cept for a period in 1941-1942, when he served as a dollar-a-year man with the Office of Production Management in Washington, he has been concerned with the engineering and manufacturing operations of the Bridgeport Works.

Mr. Clark joined General Electric in 1899 and shortly thereafter was appointed an assistant to H. F. T. Erben, who was his mentor for the next 20 years. Working with the man whose name was to become one of the most distinguished in the company, Mr. Clark played an important part in the design of the first 1,200-volt and 2,400-volt generators for direct-current railway electrifications. He entered the manufacturing and administrative field in 1916 when Mr. Erben was made assistant manager of the Schenectady Works. Mr. Clark's first real break away from engineering came in 1920, when G.E. asked him to take charge of the Bridgeport Works, at that time a small subdepartmental manufacturing operation, employing 25 people. At the time of his retirement as general works manager, he was the dean of all the company's works managers and the only manager in charge of the Bridgeport Works which the plant had.

•

▶ C. F. PUBLOW, district station engineer, Hydro-Electric Power Commission of Ontario, Toronto, has been elected president of the Royal Canadian Institute.

▶ DR. EUGENE C. CRITTENDEN, associate director of the National Bureau of Standards, and for 25 years chief of the division of electricity, has been awarded the degree of doctor of science by the Case School of Applied Science. Dr. Crittenden has just been elected to membership in the International Committee on Weights and Measures and this year was awarded the Illuminating Engineering Society Medal, the highest honor in the field of lighting. The Case School citation read: "A devoted servant of the public, exponent of precise measurement, and international authority on the standards of science and industry."

▶ PAUL E. POITRAS has been appointed joint manager, with William O'Brien, of the industrial department of the Quebec Hydro-Electric Commission. Mr. Poitras was formerly mechanical engineer in charge of the engineering department of the Steel Co. of Canada, Montreal.

▶ CHARLES H. SEEMANN, Safford, Ariz., has been appointed manager of the Graham County, Arizona, Rural Electrification Administration. The appointment was made by the electrical

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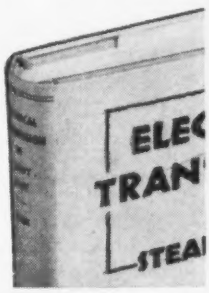

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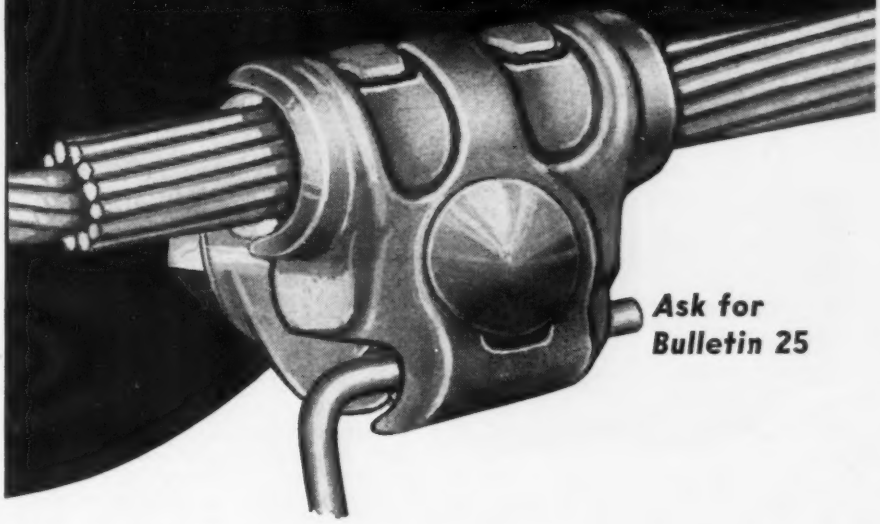

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cooperative's board of directors with the approval of Washington officials. He will have his office in Pima, Ariz. Mr. Seemann began work in the electrical field in 1918. During World War II he served as a chief petty officer, training recruits as electricians. He has been associated with the REA for several years, supervising the construction of high lines all over the West.

▶ J. U. BENZIGER, superintendent of Plant Atkinson of Georgia Power Co., has been transferred to Albany as superintendent of construction to take charge of construction of the company's new 45,000-kw. steam electric generating station. He has been succeeded by L. B. LOCKLIN, who has served at Plant Atkinson since January, 1931, as chemist, production engineer and resident engineer.

▶ GEORGE M. SHEETS, sales supervisor of the Iowa-Illinois Gas & Electric Co. at Iowa City, since the organization of the company, has resigned from that position to join "Central Surveys," a market analysis and sales survey organization headed by Charles Parker of Shenandoah, Iowa. Mr. Sheets served as commercial manager and new business manager of the Iowa City Light & Power Co. prior to the organization of the Iowa-Illinois company. He previously had been connected with the United Light & Power Service Co. and the People's Light Co. at Davenport. While with the public utility industry, Mr. Sheets was active in the Missouri Valley Electric Association.

▶ JAMES I. METCALF has joined the staff of Harza Engineering Co. as power economist in charge of the rate and system analysis section. Recently released from Naval duty, Mr. Metcalf was formerly a partner in the engineering firm of R. W. Beck, James I. Metcalf & Associates, and was consulting power economist for the Bonneville Power Administration and the New York Power Authority.

▶ C. B. MCCARTNEY, electrical superintendent of Florida Power Corp., has resigned to become a consulting engineer. Mr. McCartney joined Florida Power Corp. in 1926 as distribution engineer with the then Pinellas County Power Co. He is a graduate of the Milwaukee School of Engineering, receiving his degree in electrical engineering in 1924.

▶ WILLIS T. JOHNSON has been appointed general superintendent of the California Electric Power Co. to succeed FRANK V. WRIGHT, who has retired after 28 years of service. Mr. Johnson, Mr. Wright's assistant for the past four years, became affiliated with the Cali-

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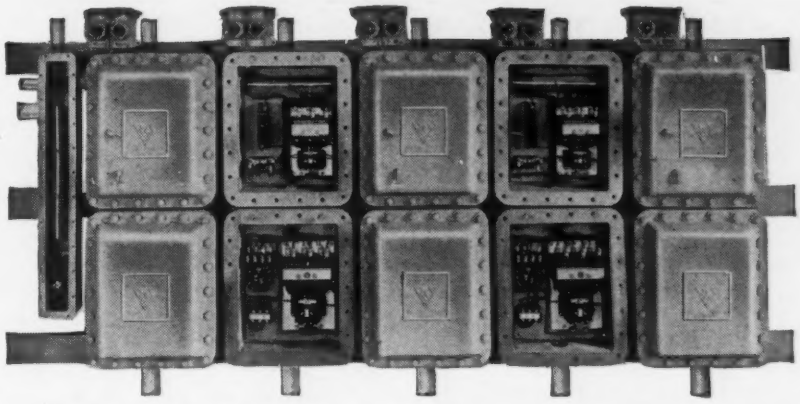

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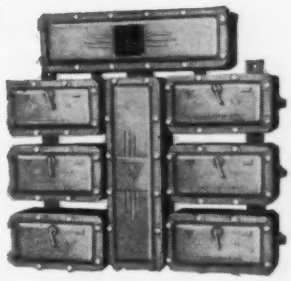

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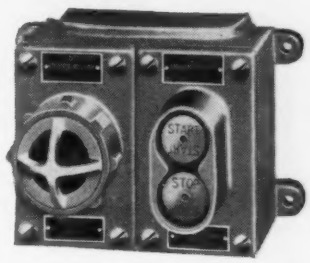

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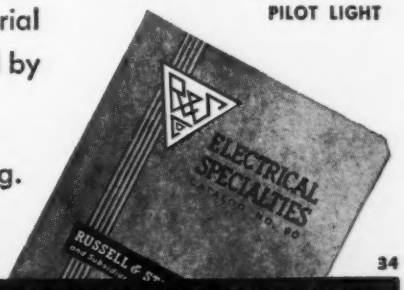

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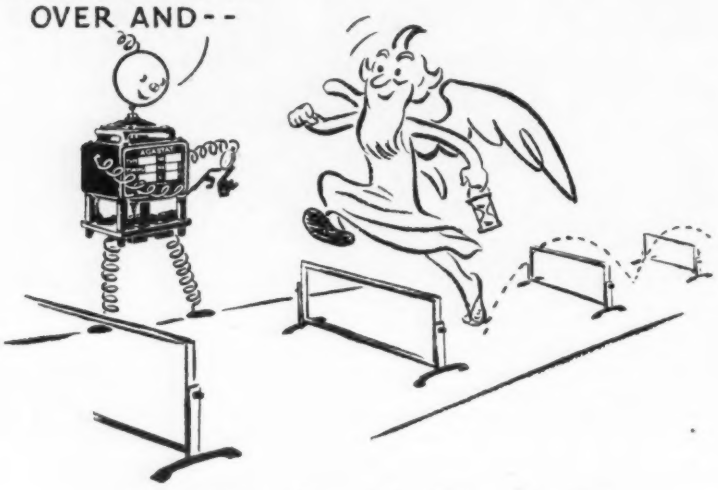

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fornia Electric Power organization in 1925 and has served as general superintendent at Yuma, Ariz., and district superintendent of operations in the Imperial Valley, California. Mr. Wright became identified with the utility in 1918 following an association with the Western Colorado Power Co., Telluride, Colo. After holding several operating positions, he was appointed assistant general superintendent in 1923 and general superintendent in 1942.

▶ HOWARD H. HOUK, a consulting engineer of Washington, D. C., has been appointed to coordinate public utility investigations of the Technical Industrial Intelligence Division in Germany. A. F. ENSRUD, North Hollywood, Calif., has been appointed investigator and document analyst for Technical Industrial Intelligence Division.

▶ FREDERICK V. AUSTIN, JR., has returned to the American Gas & Electric Service Corp. after four years' service with the Corps of Engineers, AUS, from which he retired with the rank of Lieutenant Colonel. Mr. Austin's duties with A. G. & E. will be in connection with budgetary control in the engineering department.

▶ CLIFFORD C. SIMPSON, who has had more than 20 years of experience in association management, has been appointed managing director of the National Electrical Retailers Association, Chicago, Ill. Mr. Simpson's most recent organization assignment was as general manager of the National Association of Independent Tire Dealers. He will temporarily maintain his offices in Washington, D. C., at 1304 Eye St., N.W., but later will move his operations to the association's Chicago office in the Merchandise Mart Building.

▶ RALPH R. NEWQUIST has been elected vice-president in charge of sales of Roots-Connersville Blower Corp., Connersville, Ind. Mr. Newquist has been successively employed by the Reliance Electric & Engineering Co., the Louis Allis Co., and Allis-Chalmers Manufacturing Co.

▶ H. W. BISKEBORN has joined the Canadian Comstock Co. Limited, Leaside, Ont., Canada. Formerly chief engineer of Phillips Electrical Works Ltd., Brockville and Montreal, Mr. Biskeborn has had extensive experience in England, Europe and North America in engineering equipment, design and manufacture.

▶ W. G. HOEHN, formerly electrical engineer in the engineering department, American Transformer Co., Newark,

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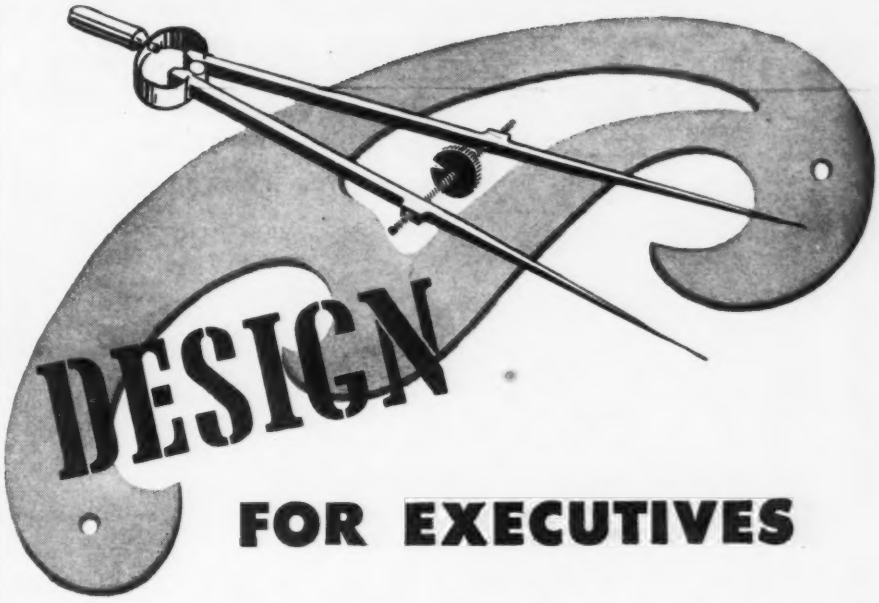

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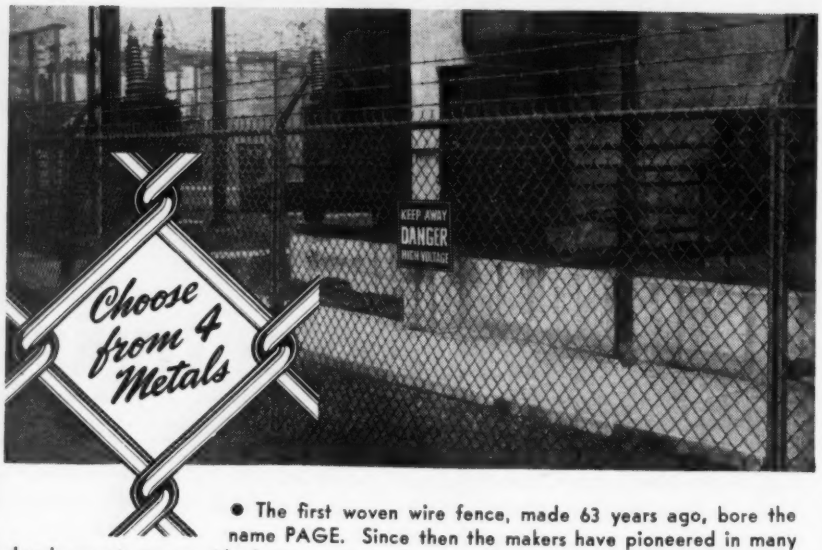

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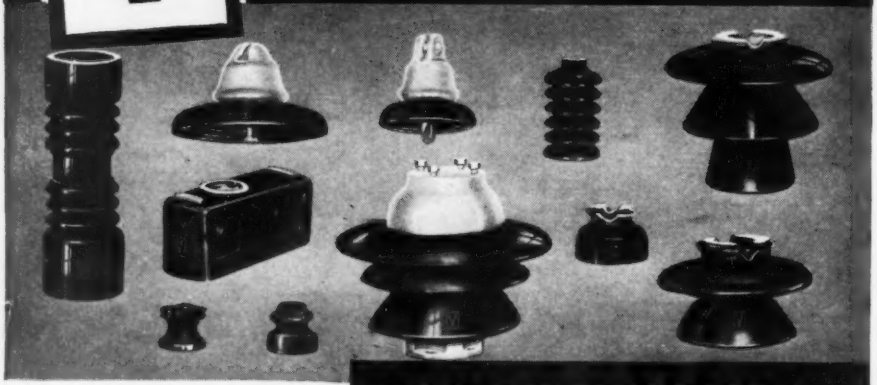

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N. J., has been made manager of power, distribution and air-filled transformers. T. W. STAUBER, formerly electrical engineer with the company, has been made manager of specialty air-insulated transformers and transtats.

▶ WARREN J. HOLMES has been named export representative in the Philippine Islands for the Allis-Chalmers Manufacturing Co., Milwaukee, and will work with the Earnshaw Docks and Honolulu Iron Works, distributors of heavy industrial equipment for the company's general machinery division. Prior to joining Allis-Chalmers in 1944, Mr. Holmes spent two years as consulting engineer with several companies.

▶ JOSEPH H. WARD, executive vice-president of Noma Electric Corp., New York, has been assigned new responsibilities as sales director and supervisory officer for all of Noma's manufacturing and sales divisions and subsidiaries with the exception of those engaged in the household durable goods field and in automotive lighting. Mr. Ward joined Noma in 1927 as manager of the lamp division. He subsequently was employed in the sales department and as advertising manager, was made a vice-president in 1938 and executive vice-president in 1945.

OBITUARY

▶EARLE F. SELLS, for many years associated with the Westinghouse Electric Corp., died recently at Doctors Hospital in Washington, D. C., following a short illness. After completing the Westinghouse student course in Pittsburgh, Mr. Sells became affiliated with the company's Denver office. In 1913 he was transferred to the El Paso (Tex.) and in 1918 to the Washington, D. C., office as a salesman. He was made manager of the Washington office in 1932 and eight years later was named special government representative for Westinghouse. In 1945 he was awarded the Order of Merit by the company.

▶ ROBERT C. WILKIN, sales manager of the insulated wire division of the Phelps Dodge Copper Products Corp., New York, died at his home in Old Westbury, L. I., on August 31, as the result of an accident while testing an oxygen diving outfit of a type sometimes used in mine rescue work. Mr. Wilkin was graduated in 1932 from Dartmouth College. Until about a year and a half ago, he made his headquarters in Los Angeles as manager of the Pacific Coast branch of the corporation. Mr. Wilkin was 36 years old.

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Industry support of the Electrical Engineering Exposition scheduled for January 27-31 is developing rapidly, E. K. Stevens, manager, made known this week. He stated that already manufacturers had indicated their intention of exhibiting the latest designs in generation, transmission and distribution equipment as well as industrial current consuming devices.

Plans for the exposition were made known by Charles F. Roth, president, International Exposition Co., and E. K. Stevens, manager of the exposition. Associated with this management in developing the plans is an advisory committee composed of J. T. Barron, vice-president, electric operation, Public Service Electric & Gas Co.; Walter S. Finlay, Jr., vice-president, J. G. White Engineering Corp.; E. S. Fitz, general manager, electrical department, Virginia Electric & Power Co.; N. E. Funk, vice-president, engineering, Philadelphia Electric Co.; C. W. Leihy, Electric Light & Power; A. L. Penniman, Jr., general superintendent, electrical operations, Consolidated Gas, Electric Light & Power Co. of Baltimore; W. A. Perry, assistant to general superintendent, Inland Steel Co.; R. C. Roe, Burns & Roe, Inc.; R. W. Wilbraham, chief electrical engineer, United Engineers & Constructors, Inc.; and Samuel B. Williams, editor, ELECTRICAL WORLD.

The exposition is timed to coincide with the winter convention of the American Institute of Electrical Engineers and will be staged in the 71st Regiment Armory, Park Ave. at 34th St., New York City.

Apparatus exhibited will be those of interest to designers, constructors and operators of electrical utility, industrial and railroad systems. These include all types of equipment from the generators up to the customer's meter and many that are used within the consumer's plant. Some of these are motors, batteries, switchboards and switchgear, solenoids, resistors and resistances, relays and regulators, rheostats, capacitors, commutators, circuit breakers, wire, cable, insulators, conduit, duct, pothead, racks, splices, towers, substations, transformers, converters, cutouts, fuses, motor generators, test sets, welders, starters, tools, panel boards, indicating and recording instruments, lamps and lighting fixtures for industrial and commercial application.

•

Trackless Trolley Systems Added to 5 Major Cities

More than $6,500,000 will be spent on new trackless trolley coach installations in five major cities, according to announcements made recently by transit systems in Denver, Little Rock, Kansas City, Los Angeles, and Portland, Ore.

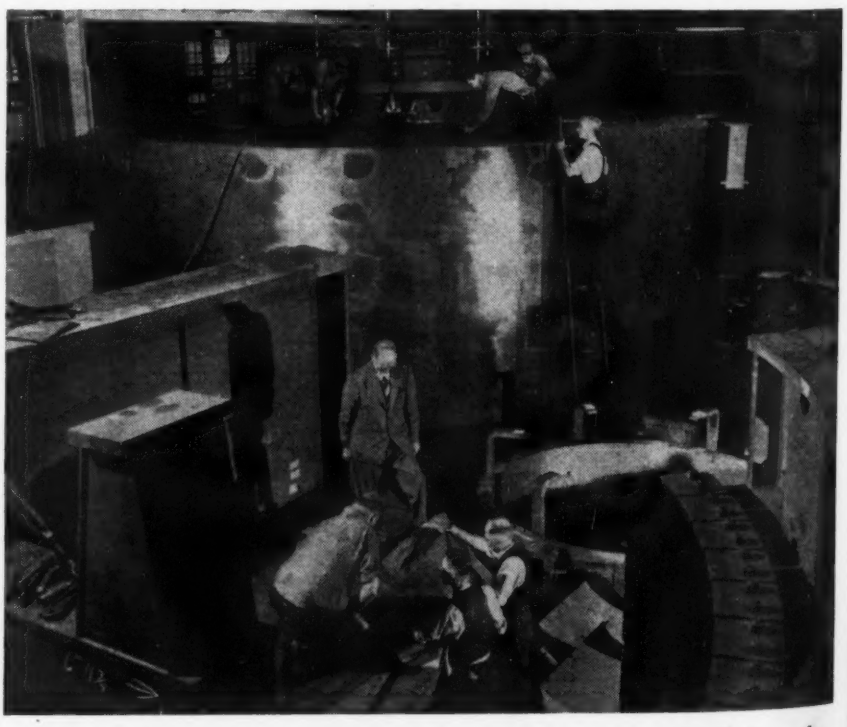
The Denver Tramway Co. will purchase 50 additional trolley coaches to modernize its service on three more downtown streets. This will make a total of 117 trackless trolleys. Los Angeles Transit Lines has ordered 120 new electric vehicles to be used on four central business streets.

Portland Traction Co. will add 50 more trolley coaches to their present fleet of 141, and the Kansas City Public Service Co. has announced further modernization plans calling for the purchase of 100 trackless trolleys to augment its 116 now in service. The Capital Transportation Co. of Little Rock has placed an original order for 29 trolley coaches.

•

A-C Gives 13½-Cent Raise; Total Addition, 30½ Cents

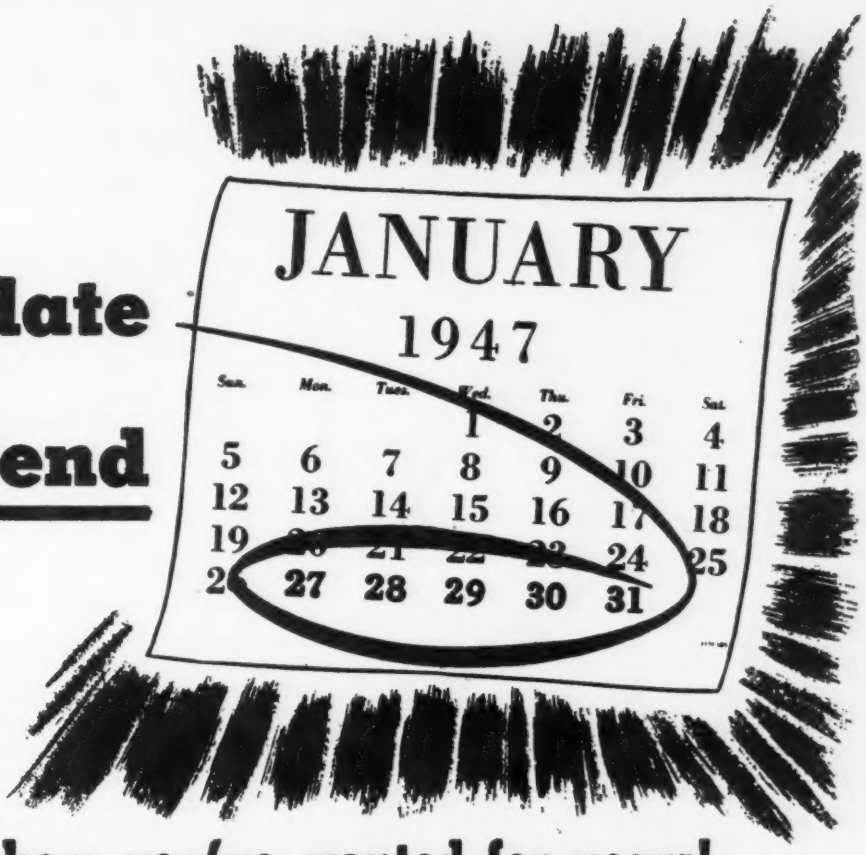
The 17 cents per hour being added at the West Allis Works, Allis-Chalmers Manufacturing Co., to the wages of employees in the bargaining unit represented by Local 248, has been increased



COMPLETING TACOMA UNIT—Finishing touches are being added to the 25,000-kva. hydrogenerator on the assembly floor at the General Electric plant, Schenectady, N. Y. The unit will be part of the second Nisqually River development and will be installed in the Alder power house. It operates under an effective head of 275 ft., runs at 225 rpm., has a housing 26½ ft. in diameter and 12 ft. high, and with coolers and exciters weighs 200 tons. Voltage at the terminal will be 13.8 kv. This unit will supplement La Grand's 40,000-kva. capacity

Mark the date

Plan to attend



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They've wanted to be able to see and compare—under one roof, in a minimum of time—the latest products for the generation, transmission, distribution and utilization of electric energy. And now they can!

They've wanted a comprehensive show. And—with over a hundred technically staffed exhibits—and this is it!

TIMED TO SERVE YOU MOST. The first Electrical Engineering Exposition is timed to perfection. It comes when there are probably more newly revealed developments than ever before in electrical history. It runs concurrently with the Winter Convention of A.I.E.E.—and conveniently near-by.

Plan now to attend. Post yourself on latest developments that will be helpful in your business. Improving your knowledge will make you more valuable to your company, by improving its products or services. Admission by registration only; general public excluded. Reserve the date now.

ELECTRICAL ENGINEERING EXPOSITION

71st Regiment Armory • NEW YORK • JANUARY 27-31, 1947

To be held concurrently with Winter Convention of American Institute of Electrical Engineers

Under management of International Exposition Co., Grand Central Palace, N. Y. C.

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Every tool tested to its full rated dielectric strength of 10,000 volts for one minute RMS before it leaves our plant.

A full range of COHARDITE insulated small tools carried in stock for meter and distributor departments.

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by 13½ cents per hour, thus bringing the total addition to 30½ cents per hour. The increase became effective on August 28.

In addition, for all such employees regularly at work on August 28, this increase will apply to all hours worked by such employees after the starting of the working day of June 7, 1946 (with application of normal overtime rules).

•

Merger Plan Approved

Stockholders of Noma Electric Corp. and Pollak Manufacturing Co., at special meetings held recently, approved the plan of merger whereby Noma will absorb Pollak on a basis of two-thirds of a share of Noma for each share of Pollak. Plans for the merger were announced by officials of both companies July 31.

•

Range Output Up 20.47%

Production of electric ranges by Electromaster Inc. in August was 20.47 percent greater than in the month of July, Gerald Hulett, vice-president, has stated. This increase reflects the efficiency of the company's new $750,000 plant in Mount Clemens and represents the first thirty days operation of the new plant's porcelain enamelling and assembly departments. Mr. Hulett stated August production was approximately that of August, 1941, and predicted a further increase, when the new plant's second assembly line is started.

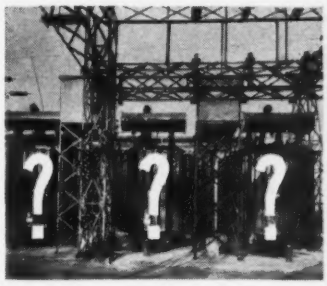
•

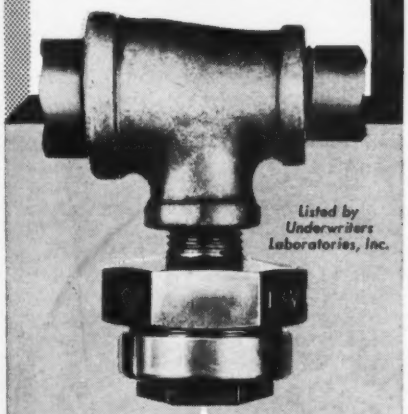
Argentine Government Buys Subsidiary of I. T. & T.

Purchase by the Argentine government from the International Telephone & Telegraph Corp. of its subsidiary, the Compania Union Telefonica, which serves Argentina with one of the most modern telephone systems, has been announced.

The principal terms of the operation include the purchase price of $95,000,000 in cash for the common and preferred stock of the Compania Union Telefonica, of which I. T. & T. owns 98 percent, and the execution of two ten-year contracts whereby the I. T. & T. will continue as technical advisers in the operation of the telephone systems and whereby the Argentine factory of the I. T. & T. and its other subsidiaries, including the Federal Telephone & Radio Corp., in the United States, will supply the Argentine telephone system with the equipment required during the term of such contract.

WHICH WILL BURN FIRST?





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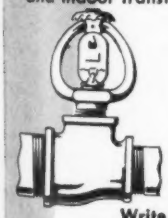
A fire in one transformer spreads quickly to others.

Blaw-Knox Aquatomic Fog Nozzles properly placed about each transformer, prevent spread of the fire and much of the damage.

Atomized water particles from the Aquatomic Nozzle are small enough for maximum cooling and quenching effect, large enough to carry straight to the base of the fire in spite of drafts, and are non-conducting to electrical current.

Blaw-Knox Aquatomic Fog Nozzles are especially suited to protection of outdoor and indoor transformer banks.



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For complete engineering details and a copy of our latest Catalog No. 40—mail the coupon below.

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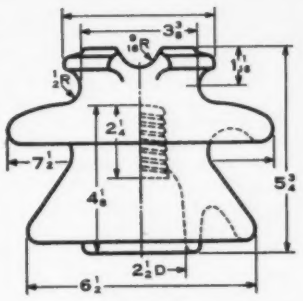
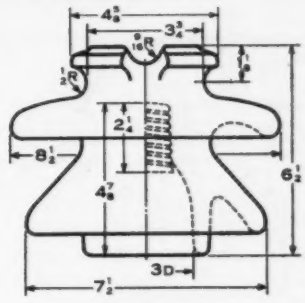


NO. 1917-M
27 Kv. Rating

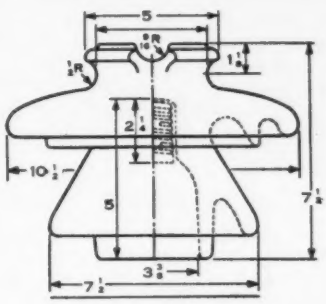
Dry Flashover	95 Kv.
Wet Flashover	65 Kv.
Rec. Pin Height	7 In.
Std. Pkg. Bbl.	25



NO. 1925-M
35 Kv. Rating

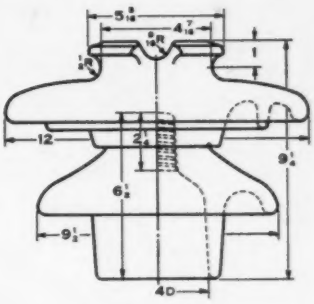
Dry Flashover	110 Kv.
Wet Flashover	75 Kv.
Rec. Pin Height	8 In.
Std. Pkg. Crate	8

All Thomas Pin Type Insulators can be furnished in "Quiet-Type" insulators for the positive elimination of insulator radio interference. To order "Quiet-Types" simply specify "Q-T" after catalog number.



NO. 1924-M
45 Kv. Rating

Dry Flashover	125 Kv.
Wet Flashover	85 Kv.
Rec. Pin Height	9 In.
Std. Pkg. Crate	6



NO. 2126-M
55 Kv. Rating

Dry Flashover	145 Kv.
Wet Flashover	100 Kv.
Rec. Pin Height	10 In.
Std. Pkg. Crate	3

The above one-piece designs can also be furnished in two-part designs when preferred. Both designs are very rugged, well balanced, and proved by years of continuous line service.

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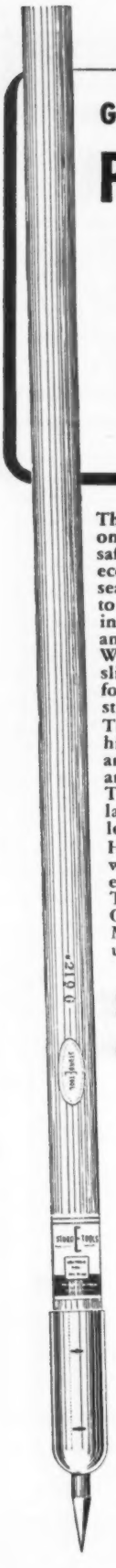
STURDE Guarded Pike Pole

The patented, automatic shield on this SturdE pike pole is a safety feature for your men—an economy feature for you. The seamless steel tube slides down to protect the point when not in use, guards it against damage and prevents accidents to crews. When action starts, the guard slides back, and *locks* to reinforce the ferrule and give added strength.

The 8¼ in. spike is forged from high grade steel, heat treated and tempered for hard service, and can be easily repointed. The fir handles are sanded and lacquered, and come in five lengths, 12 to 20 feet.

Here's a sturdy, long-life tool with a safety feature that adds extra value. Manufactured by The American Fork and Hoe Company, Cleveland, Ohio, Makers of True Temper Products.



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Exclusive SturdE feature — Automatically released tubular shield is easy to operate, locks into place and reinforces head when pole is in use. Slips down to protect point for carrying and storing.

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FIELD REPORTS ON BUSINESS

Additions to power generating capacity are expected to continue steadily during the next few years. Street-lighting activities are moving ahead. Interest in refrigeration is encouraging. Wiring supplies are still on the waiting list.

NEW YORK

Work on hundreds of millions of dollars worth of new construction in the city, including veteran and other major housing projects, face an indefinite setback if the trucking strike continues. Civil engineering construction volume in continental United States totaled $86,065,000 for the four-day week ending September 5, 1946, as reported by *Engineering News-Record*. This volume was 7 percent above the previous week and 180 percent above the corresponding week of last year.

Edison General Electric Appliance Co.'s veterans-first program has progressed to the point where 35 complete "Hotpoint" kitchens have been reserved in the New York area for veterans' houses, the local Edison General Electric distributor has reported. Blueprints of individual dwellings in different projects have been sent to the manufacturer, where layouts of the kitchens are planned. The packaged kitchens are part of the initial output reserved for veterans' homes throughout the country.

The sharp break in security prices may result in an extended delay in public utility holding company dissolution plans, it was forecast in financial circles. Two companies announced postponement of competitive bidding for common stock holdings. Consumers Power Co. postponed from September 10 to September 24 the opening of bids for $20,000,000 of its common stock and Standard Gas & Electric Co. temporarily postponed its sale of 140,614 shares of Mountain States Power Co. common stock.

Despite the break in the stock market and the trucking strike, retail trade in the Metropolitan area last week held practically unchanged at a high rate of gain over last year.

CHICAGO

In a campaign to improve retail store lighting, the Chicago Lighting Institute has built a quarter-scale model of a food store interior, in which simple controls permit changing the lights to compare low and high lighting levels and correct and incorrect placing of illumination. This display is being transported throughout Northern Illinois for demonstration purposes.

There is a backlog of some $50,000,000 in industrial construction in Chicago alone, due to non-housing building restrictions. At the same time, another factor holding back industrial development here is the complete dearth of housing facilities, which has prevented the surplus workers from downstate Illinois from moving to Chicago. The result is an artificial labor shortage here. Particularly in need of workers are firms engaged in light electrical manufacturing operations.

WAA is reconverting the $30,000,000 Illinois Ordnance Plant near Herrin, Ill., to accommodate several small industries, among which is Radionic Control Corp. of Chicago. Howard Industries, Racine, Wis., producers of fractional horsepower motors, plans to enter the electrical appliance field with fans, food and drink mixers, and drills, to which it is reportedly attracted by a "wider profit margin." R. R. Donnelley & Sons is building a $100,000 power plant at Crawfordsville, Ind.

NEW ENGLAND

Additions to New England power generating capacity are expected to continue steadily during the next two years, according to engineers who are planning for the expansion of facilities to take care of a widely diversified production field. Street-lighting activities are moving ahead; in Boston, Columbus Avenue, one of the city's busiest outbound truck routes, will be lighted by forty-six 6,000-lumen lamps located in the center strips, twenty-nine 10,000-lumen lights spaced along curb lines and a relocation of twenty-five 10,000-lumen units.

Scovill Manufacturing Co., Waterbury, Conn., has laid out a post-war expansion program, including the purchase of new machinery and the construction of additional buildings, at an estimated cost of $8,000,000. Raytheon Manufacturing Co., Waltham, Mass., has announced the installation of apparatus for a microwave communication system which will operate between Boston and New York with five relay stations interspersed at points in Massachusetts and Connecticut.

Wiring supplies are still on the waiting lists, and many Boston downtown retail store modernization jobs are being held up for lack of materials. Electric appliance counters in stores are becoming more attractive as vacuum cleaners and irons appear in larger quantities.

PACIFIC COAST

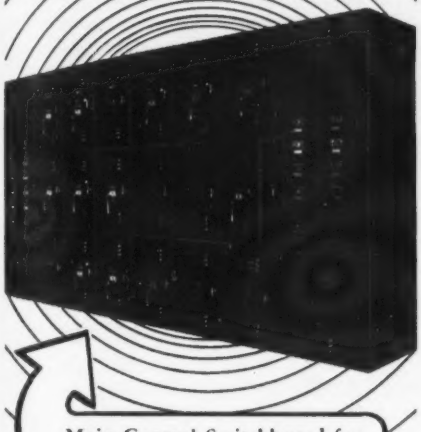
Purchases of heavy electrical machinery are topped by award to Baldwin Locomotive Works of five turbines with governors and pumping equipment, totaling $2,083,800 for Davis Dam project in Arizona. Westinghouse was low bidder at $810,476 for six 65,000-hp. motors with motor generator exciters for Grand Coulee power plant, and General Electric was low at $148,654 for a 20,000-kva.

Late September bid opening will include line construction for sectors of the Davis, Rio Grande, Missouri Basin, and Colorado Big Thompson projects. A $48,000,000 bond issue now being prepared for presentation to San Francisco voters will include approximately $20,000,000 of street work and modernization, which in turn includes an estimated $1,500,000 of traffic signal systems. This and other similar proposals, such as Sacramento's $8,000,000 proposed issue, reflect the crowded traffic lanes of most western cities for which the first solution sought will undoubtedly be modernized electrical traffic signal systems. A predicted $10,000,000 of the $75,000,000 fund for veterans' temporary educational facilities will be earmarked for the western states and Hawaii and this will include a high proportion for adequate wiring and lighting.

Why it will pay you to try

Pelham

for your next Switchboard



Main Control Switchboard for power and light company. Fully enclosed; dead-front; circuit-breakers throughout. All panels individually hinged.

1. Exceptional Engineering Service. The wide experience of our Engineering Department has included the most difficult problems of switchboard design. We can send an engineer to combine our experience with yours in planning a job.

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3. Unusual Cooperation. We take full responsibility for meeting all specifications of architects and engineers, as well as municipal, state, or federal requirements. Our deliveries are made when promised.

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SPECIALIZED DESIGN

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UNEXCELLED QUALITY

SWITCHBOARDS · PANEL BOARDS
SWITCH GEAR AND ACCESSORIES

SALES OPPORTUNITIES

CALIFORNIA—Crown Cork & Seal Corp., 25th and Potrero Sts., San Francisco, plans new one-story plant on Bayshore Blvd., South San Francisco, about 600 by 600 ft., with production machinery and electrical equipment for large output. A power substation is planned for central station service. Cost about $1,700,000. Proposed to ask bids during fall. Albert F. Roller, Crocker First National Bank Bldg., San Francisco, is architect. Main offices are at Baltimore, Md.

OREGON—California-Oregon Power Co., Medford, has secured approval of Federal Power Commission to proceed with construction of proposed hydroelectric generating station at Toketee Falls, North Umpqua River, about 50 miles from Roseburg. Project will include 35-ft. dam and 7,500-ft. tunnel to mouth of Glide Creek for stream diversion, providing water head of about 415 ft. at station. Installation will comprise hydraulic-turbine units with rating of about 53,600 hp. Ground work will proceed at once and is scheduled for completion this year, with construction of station to begin early in 1947. Project will include a new transmission line from generating station to Dixonville, near Roseburg, about 40 miles, where connection will be made with present high-tension system. New switching station will be located at latter place. Entire development is estimated to cost about $4,000,000.

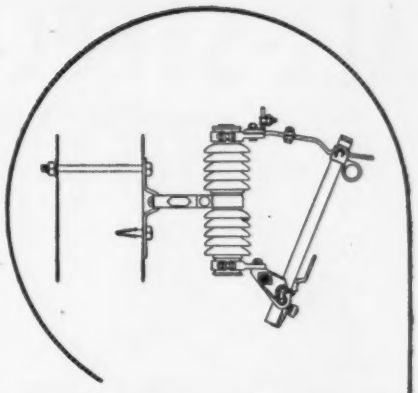
PENNSYLVANIA—Pennsylvania Power & Light Co., Allentown, will make extensions in transmission system. Contract is being placed for about 1,900 tons of galvanized steel towers, with awards to follow for other required equipment. Plan to begin when material is available.

CONNECTICUT—Scovill Mfg. Co., Mill St., Waterbury, brass, bronze and nickel tubing, stampings, etc., plans large expansion program at local plant, as well as branch factories in different parts of country, including new buildings, extensions in present structures and other facilities. Machinery and electrical equipment will be installed for heavy increase in present capacity. Project will be carried out over period of months and will represent ultimate reported investment of about $8,000,000. Financing is being arranged.

MASSACHUSETTS—State Department of Public Health, State House, Boston, has plans for new power plant at State School for infirm and crippled children, Belchertown. Construction will be carried out in conjunction with new ward building, entire project estimated to cost $848,000. CPA approval has been secured.

INDIANA—Board of Public Works, Covington, plans early call for bids for new motor-driven deep-well turbine pumping unit, with electrical controls and accessories, in connection with new pumping station for municipal water system. Boyd E. Phelps, Brinckman Building, Michigan City, is consulting engineer.

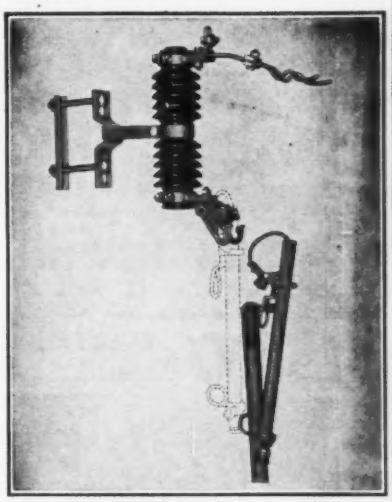
MONTANA—Anaconda Copper Mining Co., Anaconda, plans new plant at local mining properties for production of phosphoric acid, comprising a main multi-story building and several auxiliary structures,



Fuseholders can be easily and safely removed or replaced with standard ballpoint hotsticks.

Fuseholders can't be installed backwards.

Fuseholders won't weld to upper arm during heavy short circuit.



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Fusing: 100 Amperes. Rupturing capacity 2000 Amperes.

5 K. V.—7½/12½ K. V. y Grd.—15 K. V.

Try at our risk. Ask for Bulletin.

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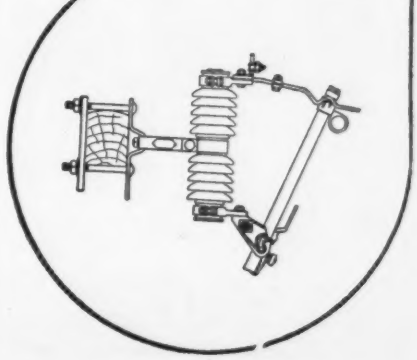

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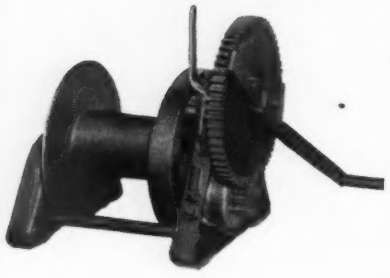
and only $75



5 TONS CAPACITY with 70 lbs. crank load . . . weight 95 lbs. . . . 16½" by 15½" by 16¾" high . . . tops for small winch handiness, usefulness and value! All-steel tail yoke weighs 5 lbs., costs $4.00 extra. Prices are F. O. B. your dealer. Write for further information. American Hoist & Derrick Co., St. Paul 1, Minnesota.

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ILSCO ELECTRICAL CONNECTORS

JUST THINK . . . . 9 SECONDS FOR A PERFECT CONNECTION
Many millions in actual use . . . because no guesswork . . . no worries . . . no special tools. Economical . . . dependable . . . connectors can be used over and over. ILSCO CONNECTORS are Underwriters' Approved, 99% pure electrolytic copper, 100% conductive.
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CINCINNATI, OHIO

with machinery and electrical equipment for large output. Cost estimated close to $1,100,000. CPA permission has been granted and work is scheduled to begin at early date. Main offices are at 25 Broadway, New York, N. Y.

ILLINOIS—Commonwealth Edison Co., Chicago, has authorized plans for new power substation at 111th St. and Vernon Ave., 50 by 50 ft., and will ask bids soon. Plans also maturing for proposed power substation at 119th St. and Campbell Ave. Holabird & Root, 333 North Michigan Ave., are architects for both structures.

OHIO—E. I. duPont deNemours & Co., Inc., duPont Building, Wilmington, Del., has authorized construction of new plant unit on site adjoining branch factory at Upton and Tremainsville Roads, West Toledo, consisting of a large two-story building for manufacture of polishes, waxes and other chemical specialties. Machinery and electrical equipment will be installed for heavy output. Cost estimated about $1,000,000.

IOWA—Town Council, Strawberry Point, B. R. Cole, town clerk, will receive bids until September 24 for extensions and improvements in municipal power plant, including installation of new diesel engine-generator unit, not less than 300-kw. rating, complete with exciter and auxiliary equipment. Stanley Engineering Co., Muscatine, is consulting engineer.

OKLAHOMA—Town Council, Newkirk, will have plans prepared at once for extensions and improvements in municipal power plant, including installation of new diesel engine-generator unit and auxiliary equipment. Bond issue of $85,000, has been authorized. H. R. Hunter, 105 West English St., Wichita, Kan., is engineer.

INDIANA—National Tube Co., Frick Building, Pittsburgh, Pa., has plans in progress for new seamless steel tube mill at Gary, comprising three large production units and several auxiliary structures, with machinery and electrical equipment for heavy capacity. Project will be carried out over period of months and will represent ultimate investment of about $15,000,000. Main power substation and several transformer stations will be located at different points of works. Company is a subsidiary of U. S. Steel Corp., New York, N. Y.

KANSAS—Town Council, Beloit, has completed financing through federal aid for preparation of plans for expansion in municipal power plant, including installation of new oil engine-generator unit and accessories. Cost estimated about $155,000. Wilson & Co., 233 North Santa Fe St., Salina, are consulting engineers.

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P.U.D. Initiative on Ballot

An initiative which would require public utility district commissioners to submit to the voters of the district any proposed acquisition of existing electric utility systems will be on the general electric ballot in Washington state in November, Secretary of State Belle Reeves has announced.

The initiative, No. 166, was certified to the general election board August 26 after a check showed it carried 78,639 bona fide signatures—28,639 more than the 50,000 required by law.

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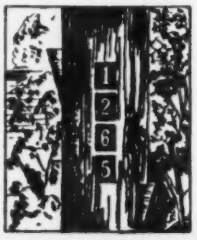

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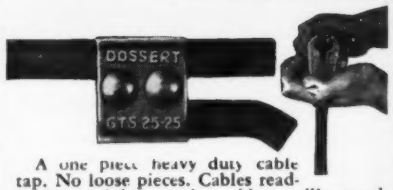

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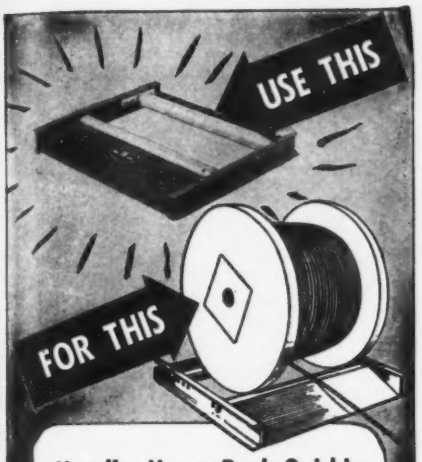

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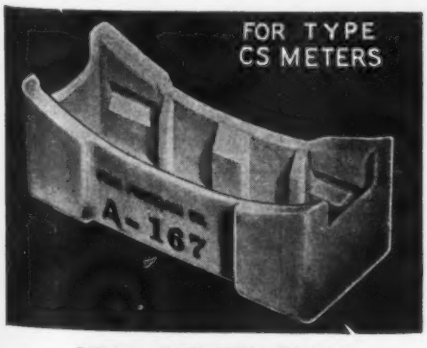

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Recent Rate Changes

MADISON (WIS.) GAS & ELECTRIC CO. has reduced its electric rates $76,254 annually for 27,175 residential and commercial customers at the request of the state Public Service Commission. Under the new rates, residential customers will save $51,131 a year, commercial users $23,157, and farm users $1,964. The rates went into effect on September 3.

KANSAS CITY POWER & LIGHT CO.'s voluntary reduction in rates, which will save consumers an estimated $1,800,000 annually, (ELECTRICAL WORLD, August 31, page 122), has been approved by the Missouri Public Service Commission. The new schedule of rates submitted by the utility provides approximately 12 percent reductions for individual consumers. The city itself will get a reduction of about $96,000 annually for the street lighting contract. The new rates became effective on September 1.

EL PASO ELECTRIC CO., Mesilla Valley division, serving Dona Ana and Sierra Counties, New Mexico, has been authorized to reduce its rates. The reduction, effective September 1, will amount to approximately $15,221 annually. The new schedule applies to commercial users and municipalities.

UNION ELECTRIC CO. has filed application to regulatory bodies of Missouri, Illinois and Iowa for approval of a new off-peak electric rate for home water heating. The new rate, which would become effective after October 1, would be 8.5 mills per kilowatt-hour to urban residential customers and 9.5 mills for rural customers; It would apply to all present and future installations of certain types of approved automatic storage-type electric water heaters used for residential purposes.

COLUMBIA (TENN.) POWER SYSTEM, acting upon authority from the Board of Public Utilities of the city, has announced a new rate schedule for commercial and industrial customers and the elemination of the 10 percent surcharge from all commercial and industrial bills for electric service based upon meter reading made after August 24. The surcharge was inaugurated as a development charge at the time of acquisition of the electric system by the City of Columbia in 1939, and its elimination will result in a saving to commercial and industrial customers of approximately $20,000 per year. Residential customers are not affected as they have never carried the surcharge.

GREER (S. C.) COMMISSION OF PUBLIC WORKS has put into effect a reduction in electric rates, which will save customers approximately $12,000 annually, according to an announcement by Carl C. Lanford, superintendent. In a breakdown of the reduction, Mr. Lanford said that the cut in rates would mean a saving of approximately $6,500 a year for residential customers. Commercial lighting customers will save $2,500 and industrial customers $1,500 or more.

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Offers City More Taxes

Gurdon, Ark., City Council has accepted the offer of the Arkansas Power & Light Co. to raise its occupational tax from $1,000 to over $1,500 by the payment of 2 percent on all company collections in the city.

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